The Welding Engineer

Founded by L. B. Mackenzie, 1916

MAY, 1925 VOL. 10. No. 5

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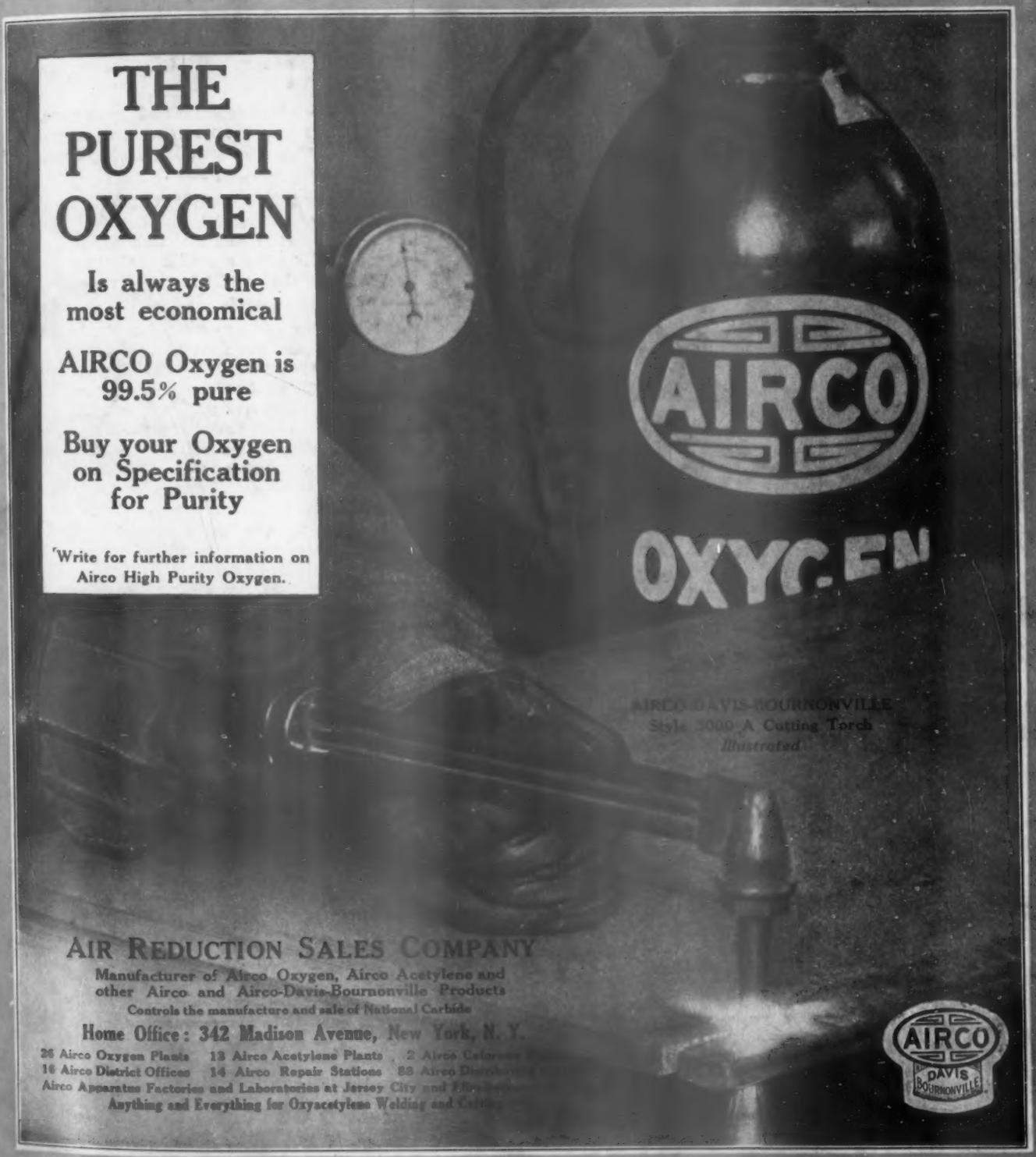
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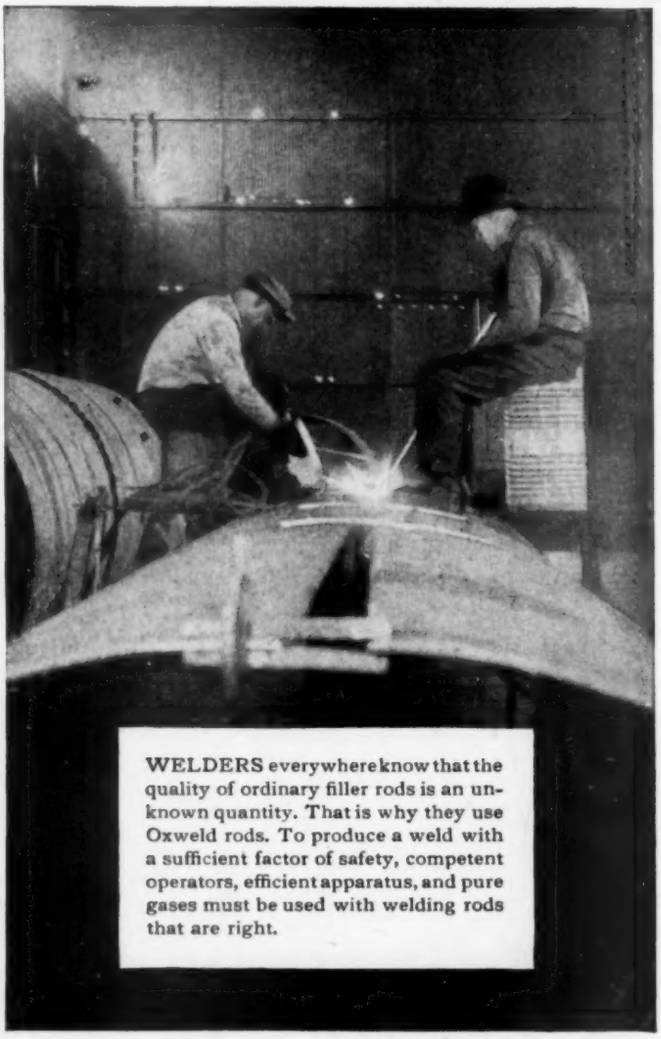
Why should you use Oxweld welding rods?



WELDERS everywhere know that the quality of ordinary filler rods is an unknown quantity. That is why they use Oxweld rods. To produce a weld with a sufficient factor of safety, competent operators, efficient apparatus, and pure gases must be used with welding rods that are right.

DIRT in the weld can be seen by an alert operator and by careful puddling he will be able to work it to the surface and remove it.

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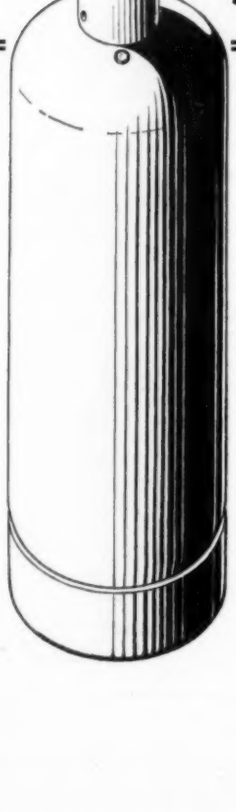

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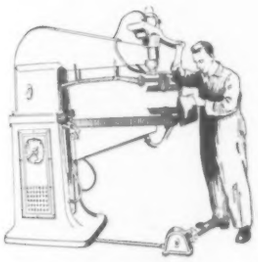

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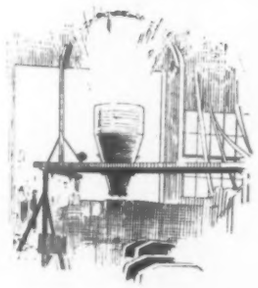

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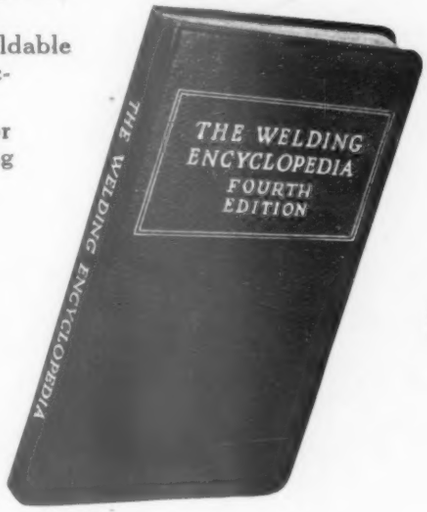

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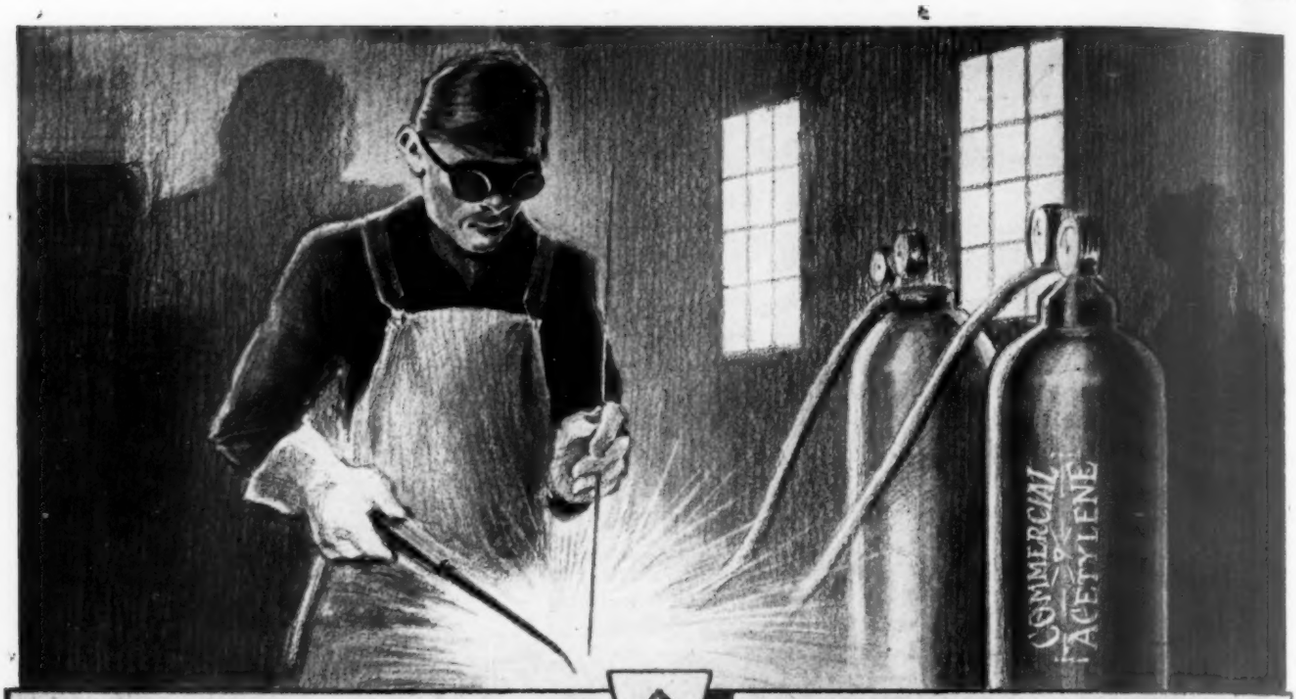

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The connecting nut to the oxygen cylinder is removable without unsweating the nipple.

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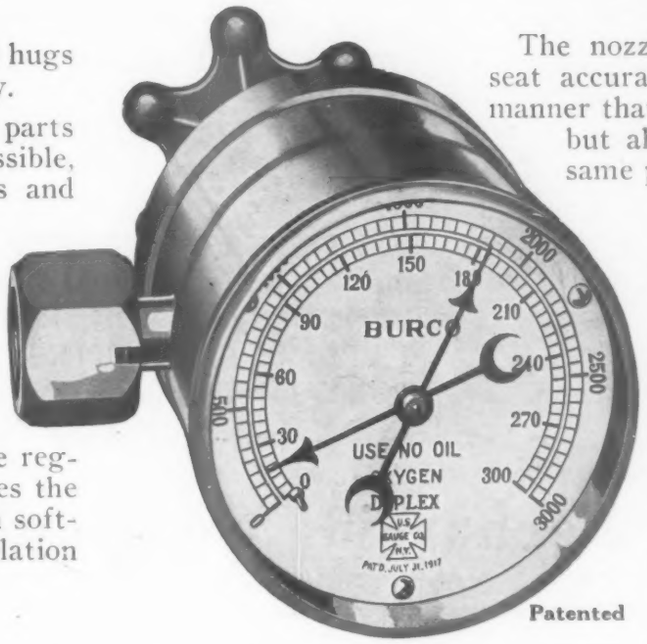

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The nozzle is large and the seat accurately guided in such manner that it cannot be turned but always reseats in the same position.

In operation this regulator delivers a full volume of gas under accurate regulation, with less fluctuation than is normally found in other regulators.

The large nozzle prevents freezing and accurate regulation means better welding at lower costs.

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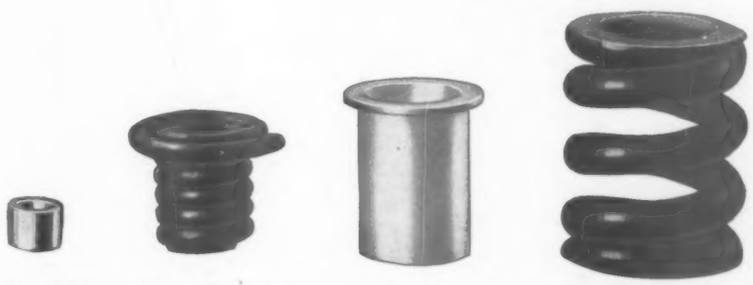

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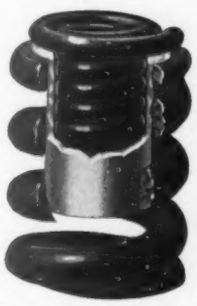

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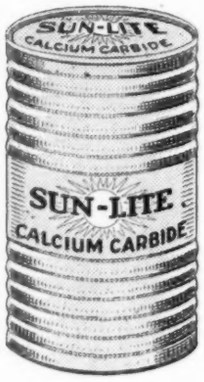

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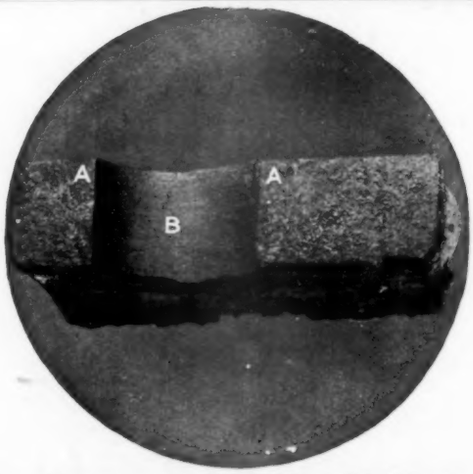

"A-A" is the welded portion.

"B" is section of hole drilled through the weld, showing uniformity of metal which is not only soft and ductile but absolutely sound and free from defects.

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¶ It dissolves the iron oxides. The slag produced not only protects but purifies the exposed surface of the metal to be welded, and also absorbs the impurities.

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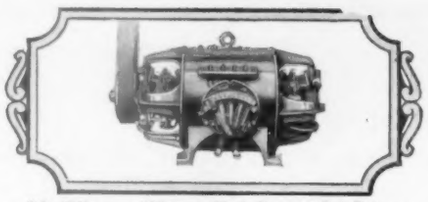
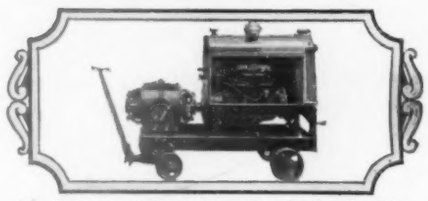
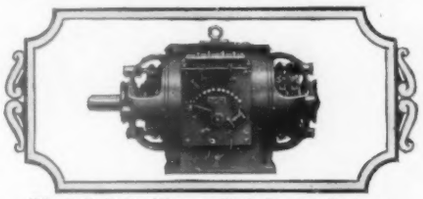


ER—1200 r.p.m.—200 amp.—Single Operator Belt Driven
Length, 33 5-8 inches Diameter, 16 1-8 inches
Net weight, 611 pounds Shipping weight, 680 pounds

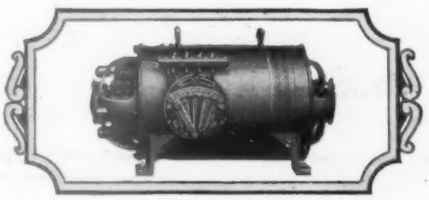


ER—1200 r.p.m.—150 amp.—Single Operator Gasoline Drive
Length, 74 inches Width, 39 inches Height, 60 inches
Net weight, 2475 pounds Shipping weight, 2775 pounds

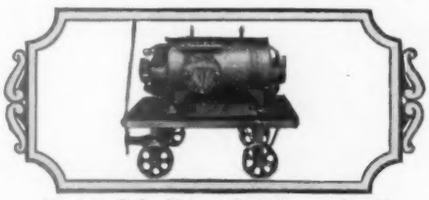


DR—D.C. D.C.—150 amp.—Single Operator Stationary
Length, 33 5-8 inches Diameter, 16 1-8 inches
Net weight, 611 pounds Shipping weight, 680 pounds

DR2—D.C. D.C.—200 amp.—Single Operator Stationary
Length, 35 1-8 inches Diameter, 16 7-8 inches
Net weight, 650 pounds Shipping weight, 710 pounds



AR—A.C. D.C.—200 amp.—Single Operator Stationary
Length, 38 inches Diameter, 17 1-8 inches
Net weight, 765 pounds Shipping weight, 840 pounds



AR—A.C. D.C.—200 amp.—Single Operator Portable
Length, 46 inches Width, 24 inches Height, 12 inches
Net weight, 880 pounds Shipping weight, 955 pounds

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By A. G. Bissel†

IT WILL be of interest to architects and structural engineers to know that the office of H. T. Krausch, Engineer of Buildings of the Chicago, Burlington and Quincy R. R., has designed and built a 40′ x 60′, one-story, mill-type building in which all of the structural-steel members were united by electric-arc welding. This building was erected from scrap structural material after several test welds were made to determine the efficiency of an arc-welded joint made of this class of material. The tests made and the results obtained described in a report to the Engineer of Buildings of the C. B. & Q. R. R. are as follows:

Shear Test:

Sample No. 1 was prepared for a shear test. This test piece was made by welding a piece of 4″ x 3″ x ⅜″ x 8″ angle to the flange of a piece of 10″ x 15 lbs. per-lin.-ft. channel. The contacts of the two edges of the angle across the flange of the channel were welded.

Total area welded = 4¼″ x $\frac{5}{16}$″ = 1.33 sq. in., the apparent weld being actual weld in this case.

Failed at a load of 46,500 lbs.

Ultimate strength per lin. inch of $\frac{5}{16}$″ welded fillet equals 10,950 lbs., obtained by dividing 46,500 lbs. by 4¼. Ultimate fiber stress per sq. in., (46,500 lbs. divided by 1.33) equals 35,000 lbs.

The fracture showed a fairly good weld. About 20% of the upper weld was of a crystalline texture which broke in tension partially in material of the welded member and partially in the welding material. The lower weld was very good and broke in shear, showing a fine silky fibrous fracture. This fracture occurred in the welding material.

Tension Test

The test piece (sample No. 2) consisted of two pieces 4″x3″x⅜″ angles partially welded together, end to end, with a total area apparently welded together of 4$\frac{1}{16}$″x⅜″, or 1,523 sq. in. The portion of actual weld as shown by break was .5937 sq. in., and the percentage of perfect weld equals 39%.

Failed at a load of 38,070 lbs.

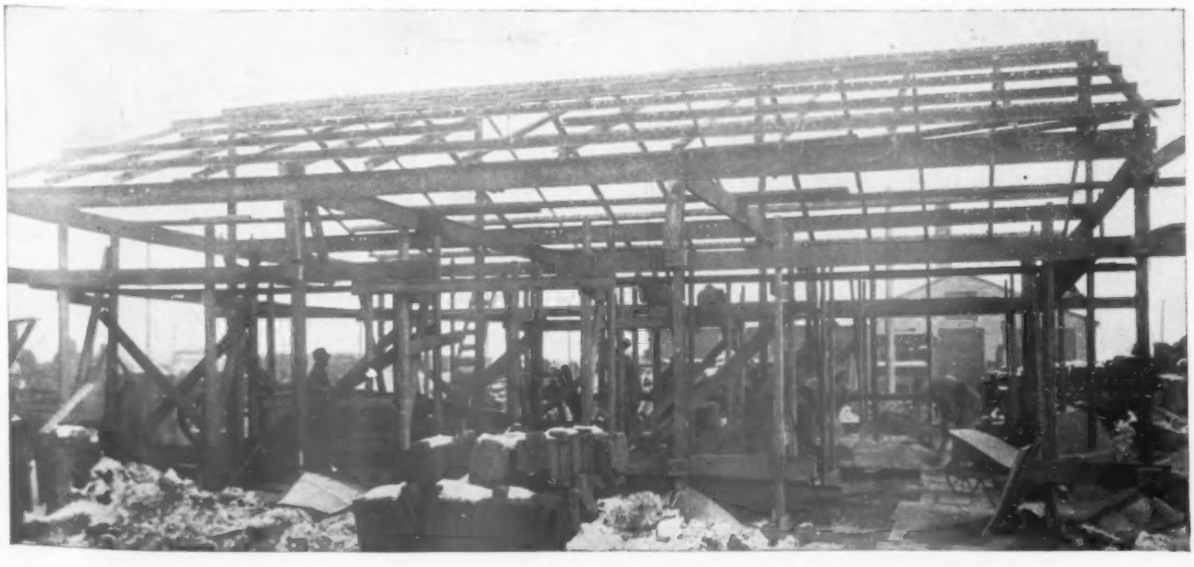
The ultimate strength per lineal inch of apparent weld (38,070 lbs. divided by 4$\frac{1}{16}$″) equals 9400 lbs. The ultimate fiber stress of actual weld (38,070 lbs. divided by .5937) equals 64,120 lbs. per square inch. The angles were welded with an approximate gap of ⅛″ between the ends of the angles. This gap was not filled in from one side, but from both sides. One portion of the weld was overheated. Another portion showed a large cold shut, which reduced the effective welded area as above noted.

The fracture in the properly welded area showed a high quality texture for steel, silky and fibrous.

Sample No. 3 consists of a 6″, 12½-lb. I-beam welded endwise on the back of a 10″, 25-lb. channel. The total area of apparent weld is 3$\frac{5}{16}$″x¼″=.8281 sq. in. The total load at failure of weld was 23,100 lbs. The ultimate strength per lin. in. of apparent weld (23,100 lbs. divided by 3$\frac{5}{16}$″) equals 7100 lbs. The ultimate fiber stress (23,100 lbs. divided by .8281) equals 27,900 lbs. per sq. in.

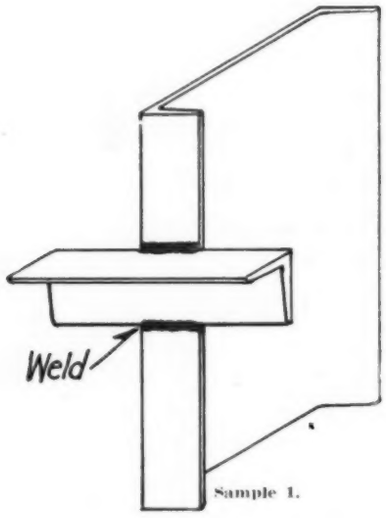
*Data furnished by H. T. Krausch, Engineer of Buildings, C. B. & Q. R. R.

†General Engineering Dept., Westinghouse Electric & Mfg. Co.

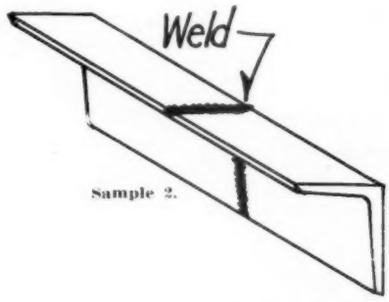


General View of Structural-Steel Building Erected by C. B. and Q. at Eola, Ill. All Joints Made by Arc-Welding.

The welding of this specimen was good and the fracture took place in the material of the two members welded together. The fracture showed a crystalline surface over a large part of the area. Both the pieces of material used for this test were badly deteriorated from corrosion and rust.

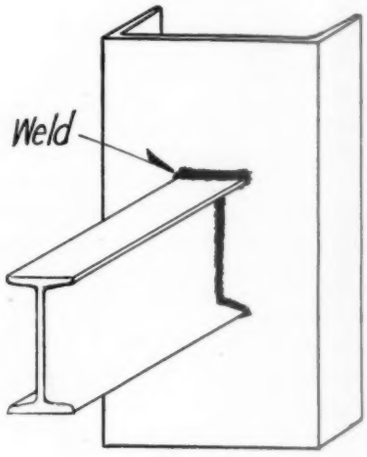


Sample 1.



Sample 2.

Sample 1—Attaching Angle to Channel for Shear Test. Sample 2—Joint in Angles to Be Tested in Tension. Sample 3—Joint Between I-Beam and Channel Tested in Tension.

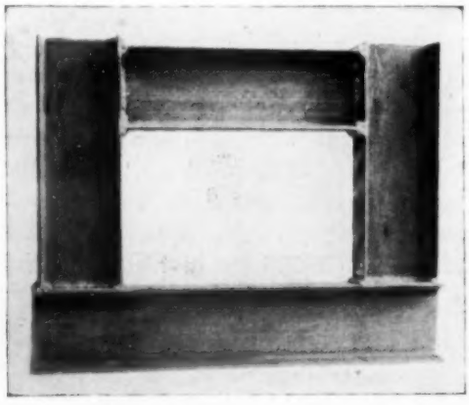


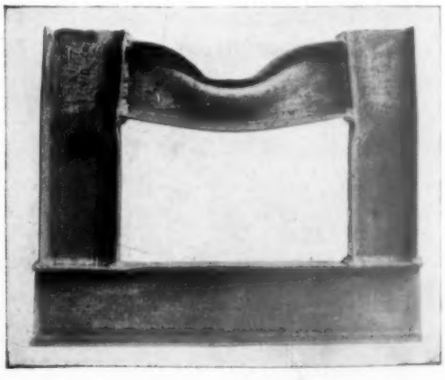
Sample 3.

Conclusions Made from Tests

The above tests and procedure were described and thoroughly gone over with all the members of the drafting room. It was pointed out to them that the company was interested in the success of electric-arc welding as a means of connecting structural members in the field, both from the standpoint of cost of material and labor and the time saved in the erection of these buildings and the economy effected by using material that heretofore had been considered scrap in a large measure. After exhibiting the test pieces and relating the results obtained from the test an attempt was made to give the draftsmen some practical information that might be used in the details of structures to be fabricated and erected by the electric-arc welding method.

The average ultimate strength of a weld $\frac{5}{16}$"x$\frac{5}{16}$" bead, which includes ¼" of added material and $\frac{1}{16}$" penetration of flux into the materials of the members welded together, under test, ran from 7100 to 10,950 lbs. per linear inch of weld, that is $\frac{5}{16}$ of a square inch of apparent weld. 10,950 lbs. was fairly high and 7100 lbs. was quite low. Assuming an average of say 8000 lbs. per linear inch for ultimate strength of this $\frac{5}{16}$"x$\frac{5}{16}$" bead and dividing by 4, for a factor of safety, we obtain 2000 lbs. per lin. in. A ⅜"x⅜" wide bead would then give an additional 20% or 2400 lbs. per lin. in. of apparent weld for a safe working unit. This is equivalent to a safe working fiber stress of 6500 lbs. per sq. in. of apparent welded area (tension and shear).





Left.
Arc-Welded Structural-Steel Test Piece Made of 6 in. 14¾ lb. I-Beam.

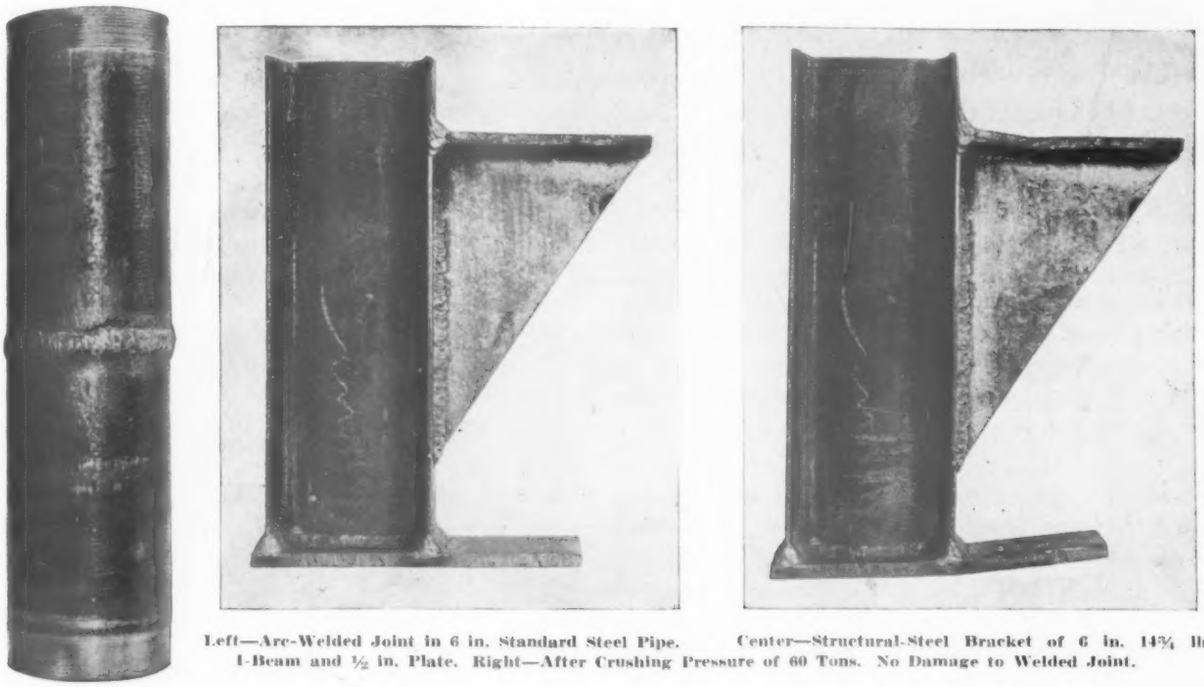
Right.
Same Test Piece After Withstanding a Crushing Pressure of 40 Tons Without Damage to Welds.

Considering the inexperience of most of the welders

COMPARISON OF ERECTION COSTS OF ARC-WELDED AND RIVETED BUILDINGS

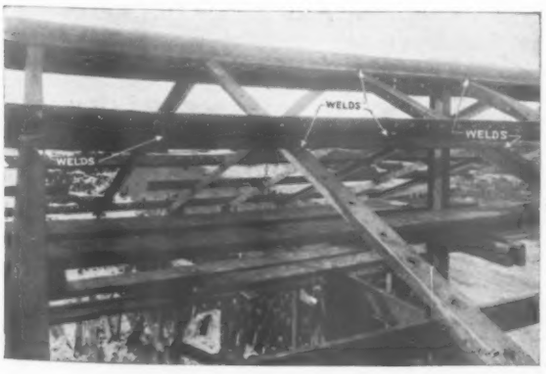
Arc-Welded Building		Riveted Building	
Preparation		**Preparation**	
Reclaiming, Collecting and handling Material	$253.61	Engineering Shop Details and Drawings	$120.00
Material, 25,619 lbs. at ½c	128.10	Shop Fabrication	745.00
		Material, 27,100 lbs. at ½c	135.50
Preparation Total	$381.71	Preparation Total	$1,000.50
Erection		**Erection**	
Welder's Time and Material	$ 94.86	Erection Riveting	$339.00
Cutting, Fitting and Erecting	309.63		
Erection Total	$404.49	Erection Total	$ 339.00
Grand Total	$786.20	Grand Total	$1,339.50

on the railroad, especially in handling structural members, where the members themselves are in many cases badly corroded, painted and rusty, this fiber stress is recommended as safe. After operators have become more experienced and other tests have been made to exhibit their efficiency in welding, this safe fiber stress per square inch undoubtedly can be increased.



Left—Arc-Welded Joint in 6 in. Standard Steel Pipe. Center—Structural-Steel Bracket of 6 in. 14¾ lb. I-Beam and ½ in. Plate. Right—After Crushing Pressure of 60 Tons. No Damage to Welded Joint.

In a paper prepared for the proceedings of the American Welding Society of 1921-1922, "Welded Structures," by A. M. Blenus, C. E., topic II, discourse E, states for the value of the welded joint:



Method of Attaching Roof Purlins to the Rafters in Arc-Welded Building.

"The stresses in most welded joints will be shear, so welds may also be subjected to tension and compression. The material in arc welding is figured at 45,000 lbs. per sq. in. of tension (tests show this figure to be low), and the same in compression. The shear value is taken at $\frac{8}{10}$ of the tension strength. From these we have as working stresses 11,000 lbs. for tensions and 9,000 lbs. for shear."

The article written in the *Railway Age* of May 25, 1922, by Mr. E. S. Humphrey, Jr., of Union College, Schenectady, N. Y., and assisted in preparation by Prof. Frank P. McKibben of Union College, and B. C. Tracey of the General Electric Co., concludes that the ultimate strength per lin. in. ¼"x¼" is 7470 lbs. These stresses were obtained from a series of actual tests made. The material used was new stock and the welding done by experienced men. They have been corroborated by tests made at Aurora, where the welds could be considered good.

Using these tests as a basis, a 40'x60' mill-type building was designed, using structural steel salvaged from the scrap pile. A general view of this building during the erection is shown. In many instances the members used were much heavier than necessary, but these were used not because of their extra weight but

Method of Attaching Roof-Truss Supports to Central Column in Arc-Welded Buildings.

because they were in the scrap and available to be used. In another view the method of attaching the roof truss supports to a central column is illustrated. The absence of gusset plates and re-enforcing bars is quite noticeable as the results of the foregoing tests indicate that the added re-enforcing is unnecessary. The method of attaching the roof purlins to the rafters is also shown. In this case, a tack weld at the heel and toe of the angle is all that is necessary.

A second buliding of the same dimensions was built and the cost data which was kept on both jobs presents a very interesting comparison as may be seen in the table.

From a study of the above figures it will be seen that the great saving in favor of the arc-welded building lies in the saving in structural material, layout and shop fabrication. The reason the erection costs of the arc-welded building exceed the riveted building is because all fabrication was done during erection, while in the riveted building much of this was done in the shop.

The use of arc welding in this work eliminates the necessity of using gusset plates and butt straps, thus making a reduction of 5½% in the weight of the steel used. No shop work, as punching, reaming and riveting or shop fabrication, was necessary, as the steel was cut to length on the job. All of which resulted in 44% reduction in the total cost of the building.

As has been stated these buildings were built of scrap material and some members were heavier than necessary, so it is to be expected that where new materials are used that equal if not greater savings may be made. Additional experimental work is being done in this class of work and it is expected that very interesting information will be procured.

NEW AIRCO ACETYLENE PLANT AT KANSAS CITY

The new acetylene plant which has been under construction at Pawnee and Packard Sts., Kansas City, Missouri, was put into operation by the Air Reduction Sales Company during the week of April 6th. The erection of this new plant is an indication of the industrial importance and growth of Kansas City and also of the constantly increasing use of acetylene welding and cutting in the manufacturing plants, machine and repair shops, garages, etc., in that territory. The property on which the plant is located is at the foot of Packard Street and arrangements have been made for a siding connection with the Kansas City Southern Railroad. It is stated by officials of the company that the erection of this plant only two miles trucking distance from the center of West Bottoms together with the highly developed engineering methods employed by this company will insure uninterrupted distribution to meet the constantly increasing demand from the whole Kansas City district. The facilities of the company now include 26 oxygen plants, 13 acetylene plants, 2 calorene plants, 88 distributing stations, 16 district offices, 14 apparatus repair shops and a highly developed factory for the manufacture of welding and cutting torches, machines and apparatus. The company maintains its experimental and research laboratory at Jersey City and Elizabethport, New Jersey. It also has an institute at Jersey City where instruction in theory and practice of oxy-acetylene welding and cutting is given to mechanical executives of their customers as well as to their own sales force. In addition, the company maintains industrial and railroad engineering departments for the purpose of placing the economies of oxy-acetylene welding and cutting at the disposal of its customers and helping to solve their production, repair or maintenance problems.

WELDED HAND TRUCKS

The Lincoln Electric Company of Cleveland has successfully applied welding to the construction of heavy duty hand trucks, for their portable welders and also used in its factory to transport parts and materials about the plant. The trucks are built by arc-welding structural steel members into a complete unit. The company has found it much more economical to construct its own welded steel trucks than to purchase other types in which cast iron and wood are employed.

The strength of the welded trucks is said to be much greater than that of other available hand trucks of equal capacity. At the same time the weight of the truck, through the use of welded steel, has been materially reduced thus making it less difficult to move the trucks even when they are heavily loaded. It is estimated that the strength of these steel hand trucks is five times that of those of equal size constructed of cast iron. This in turn means that the trucks, costing less, still have a much longer life than the older type.

All Welded Hand Truck.

The construction of this equipment from steel has only made possible, according to J. F. Lincoln, vice-president of the company, through the advance of the application of welding during recent years. Even the wheels of the steel trucks are made through the use of welding. The sides of the wheels are two disks, the tread a circular band with ends welded together to form a ring. At the center a piece of tubing is welded and machined internally to serve as a journal for an axle and ten rollers, giving a roller bearing.

CRAMP CO. REPORTS GOOD PROSPECTS

The varied activities of the William Cramp & Sons Ship & Engine Building Company enabled the company to show a substantial profit for 1924 with excellent prospects for increased business in every department during 1925, according to the annual report submitted to the stockholders Thursday, April 30, by President J. Harry Mull. Important contracts in the hydroelectric power field have been the natural result of record efficiencies shown by recent installations of hydraulic machinery. Capacity production is predicted throughout this year by another branch of the company devoted to the manufacture of oil engines, refrigerating machinery and similar products. With an improvement in general industrial conditions an increased volume of business is also looked for by the company's steel foundry. The company also operates the world's largest marine brass foundry, the business of which has been increasing.

In his report to the stockholders Mr. Mull reviewed all the activities of the several departments into which the parent company is divided, and its subsidiary companies, namely, the Federal Steel Foundry Company, the De La Vergne Machine Company and the Pelton Water Wheel Company, for the fiscal year ending December 31, 1924.

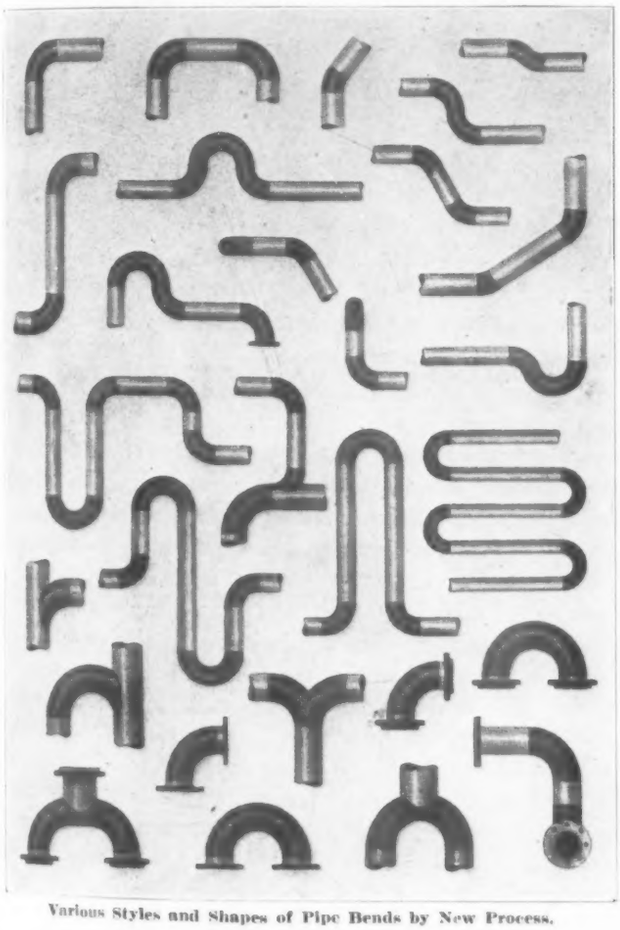
The iron foundries at the Cramp plant have been enlarged and developed and are now used for the manufacture of iron castings for the De La Vergne Machine Company, as well as for the Marine, I. P. Morris and Atlantic Pelton departments. During the year an iron foundry with electric furnace was installed which specializes in the manufacture of high-grade castings of smaller sizes, particularly for oil engine work, the performance of which has been eminently satisfactory.

The Federal Steel Foundry Company was not operated at capacity throughout the year, due to the generally poor condition of the steel casting business, but with an improvement in industrial conditions, an increased volume of business in steel castings is looked for. The volume of business booked for the brass foundry has been increasing at a satisfactory rate.

New Pipe Bending Process

Smooth Pipe Bends Promise Many Improvements in Large and Small Pipe Installations

A METHOD of producing wrought iron pipe bends for welded connections is now being introduced into this country, and, if the expectations of engineers who have examined samples of the work are realized, the field for welding in pipe work of all kinds will be considerably broadened. The process has been in operation on a commercial basis in Germany for about four years and it is reported that the popularity of the product is constantly growing. M. Keith Dunham, President of the Keith Dunham Company, Chicago, Illinois, has purchased the American rights on the patents covering the production process and plans are being made for the production of pipe bends here. A study of the illustrations which



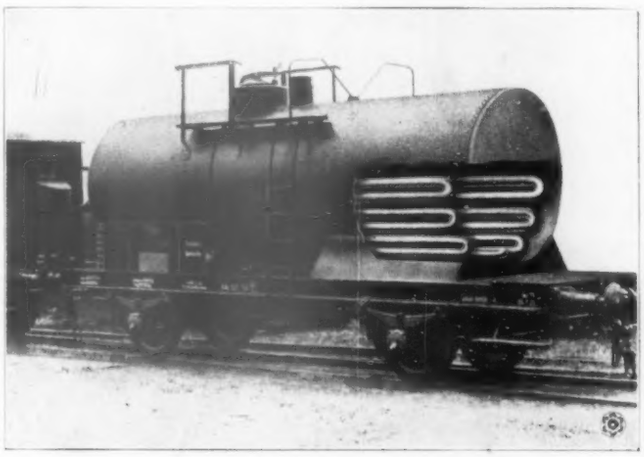
Various Styles and Shapes of Pipe Bends by New Process.

acompany this story will disclose to welders who have worked on various kinds of pipe installations the possibilities which are offered in fabrication through the availability of a product of this sort.

Although there is nothing new about the idea of bending pipe, previous methods of bending have had their drawbacks. Therefore, the makers of pipe bends of the kind shown here emphasize the following features: (A) Uniform thickness of wall, (B) Perfectly smooth surface, (C) Smallest possible bending radius, (D) Minimum of weight, (E) Simplicity of assembling, and (F) Absolutely circular cross section. The makers claim that the product as furnished to date has fully justified the confidence placed in it to such an extent as to have become a real necessity of the trade.

The high perfection which the welding process has reached and the almost universal application of this method of connecting pipes favors the use of pipe bends of this description so that the manufacturers are inclined to place practically no limit on their applicability. In every pipe line where changes of direction occur varying from 45 to 180 degrees pipe bends can be used most advantageously.

One of the best known methods of making pipe bends up to the present time has been to fill the pipe with sand, heat it over a fire and then bend it to the necessary degree.



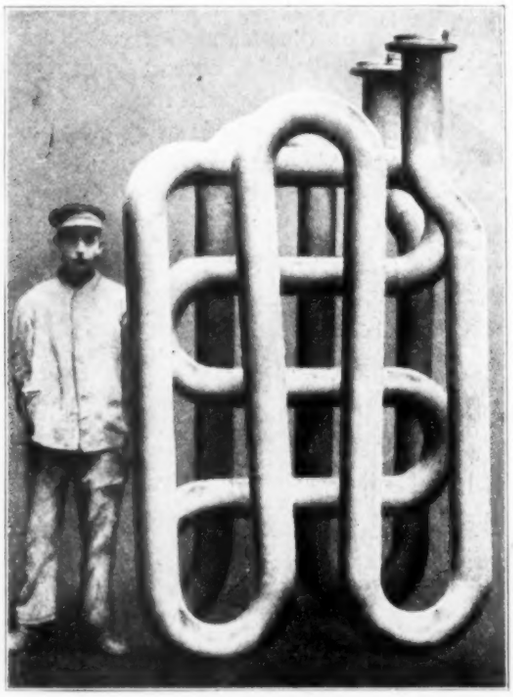
Pipe Bends Will be Welcomed by Tank Car Manufacturers.

As the result of this process the metal on the outside radius becomes stretched while the metal on the inside radius undergoes a compression. It frequently happens that the space available for pipe line is very narrow and so it is necessary to use bends with a very small radius; as, for example, when pipe line are used within vessels. In such cases it has been pointed out that the compression of the metal may cause the formation of ridges while the stretching of the metal on the outside radius is liable to weaken the pipe wall.

The patented process under discussion eliminates completely the disadvantages mentioned above, as the makers offer bends of perfect shape with no uneveness, having a perfectly smooth inside and outside surface, with uniform thickness of wall throughout. These bends, by the way, are drawn or rolled seamless tubing or pipe. Pipe di-

ameters which have been handled so far vary all the way from 1 inch to 20 inches. The center to center dimension of the standard 180 degree pipe bend is now three times the pipe diameter in the clear.

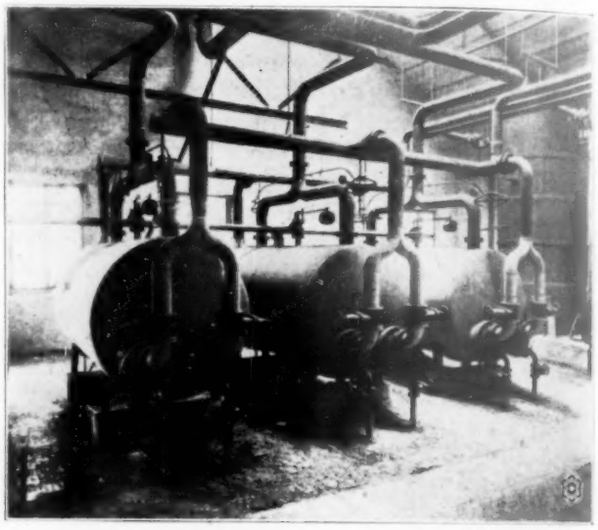
One of the illustrations is made from a cut away photograph which shows the construction of a tank car, taking advantage of pipe bends made in this manner. The construction of heating coils of this type have given tank car manufacturers in this country considerable trouble because the danger of steam escaping through screwed connections makes that type of construction almost impossible for some tank cars, and it has been a big problem to fabricate such coils by welding, using minimum material and to occupy minimum space. The pipe used for such work is apt to be larger than necessary because of friction losses and since friction losses are reduced to the minimum by using pipe bends it is reasonable to agree with the manufacturer that the use of pipe bends will make possible a considerable reduction in the size of pipe required for the job.



One Piece Construction Easily Made With Straight Lengths and Bends.

Those who have followed the progress of the welding industry in extending the application of welding to the construction of refrigerating machinery, coil pipe line installations, gas mains, oil refinery installations, steam lines, etc., have seen a great many suggestions made for the construction of returns and elbows from straight lengths of pipe. A good deal of this construction has been highly satisfactory in operation and more economical in construction in the use of fittings but such construction is bound to result in a higher percentage of friction losses than would be the case with smooth, circular turns. Some of them also require quite a number of welds to make one turn or elbow. One recent installation required seven butt welds to make one turn, while only two welds would have been necessary if return bends of this type had been used. Friction losses would have been reduced to a minimum and other things being equal a stronger construction would be made possible, placing the weld in a location where the least strain would come.

In pipe line installations of all kinds, the number and design of bends and turns is an important factor in determining the size of pipe required. Bends or elbows made by welding pieces cut from straight lengths are often preferred to cast fittings, but on account of friction losses the size of pipe required may often be larger than would be



Notice Absence of Fittings at Elbows.

necessary if all turns were made on smooth curves. Therefore, the use of bends may often make possible a reduction in the diameter of the pipe used in the line, in addition to cutting down the number and size of welds, and putting the weld in a better position in the line.

A group of the different methods of application of pipe bends is shown in one of the illustrations to indicate the flexibility of the idea. It will be seen that it is not necessary to have special bends made for every conceivable angle and pattern because one of the standard bends can be cut to provide for turning almost any kind of a corner. This is quite an important feature in outside work where unexpected demands arise for special shapes and where it would mean a great saving in time to be able to fabricate the required corner on the spot with a hack saw or cutting torch. Shipyards, mines rolling mills, chemical works, refrigerating plants, refineries, gas companies, etc., offer big possibilities for the welding industry which have not yet been developed to the utmost, and it is thought that with the ingenious solution of many construction problems offered by the use of satisfactory pipe bends the progress of the industry in this direction will be considerably hastened. In many cases the savings effected will be represented by the saving in cost as compared to the cost of cast fittings. In many cases also the saving will be represented in the use of a smaller pipe made possible by great reduction in friction losses. Savings will also be possible in cases where welding is the present practice by reducing the number of welds necessary to make an elbow or a turn.

Railroad Welding Methods

Locomotive Frames—Driving Wheel Spokes—Coupler Pockets—Trailer Frame Radius Castings—Tanks—Taps —Fire Boxes—Flue Sheets—Mud Rings

By J. S. Heaton*

WE WELD all frames with the electric process, whenever available, at points where the electric is not available, we use either the acetylene or Thermit. In preparing a frame for a weld the following procedure is strictly adhered to:

Tram frame and check with opposite side, then tram over break, locating points by which the expansion will be governed, allowing ⅛" to 3/16" according to size of frame. Frame should be cut with a double V when possible by the use of the cutting torch. Clean the surface with a sandblast and chip all the remaining burnt metal with a hammer and chisel.

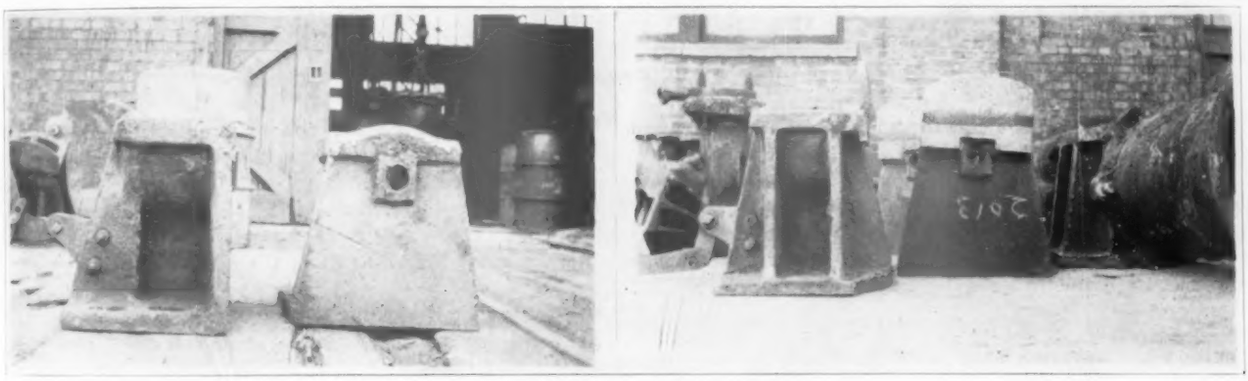
Obtain the proper expansion by using a jack or by heat if necessary.

Continue this method until the opening has been filled completely.

A piece of boiler plate ⅜" thick and one inch smaller than the weld, should be applied to the top for reinforcing. This plate has ¾" holes punched in each corner and in center. The holes are filled with welding and the edges are welded to conform to the welding on the frame.

When a jack is used for expansion it must be removed after the welding has been one quarter finished, this will allow for contraction without stresses.

When using heat for expansion, it should be applied during the entire operation.



Aprons Welded on Old Type Coupler Pockets.

Apply a ⅜" boiler plate under the broken part, allowing the plate to extend one inch beyond the end of the break and to extend ½" wider on each side of the frame. This extra width will take care of the reinforcing rods which are added as the welding is added.

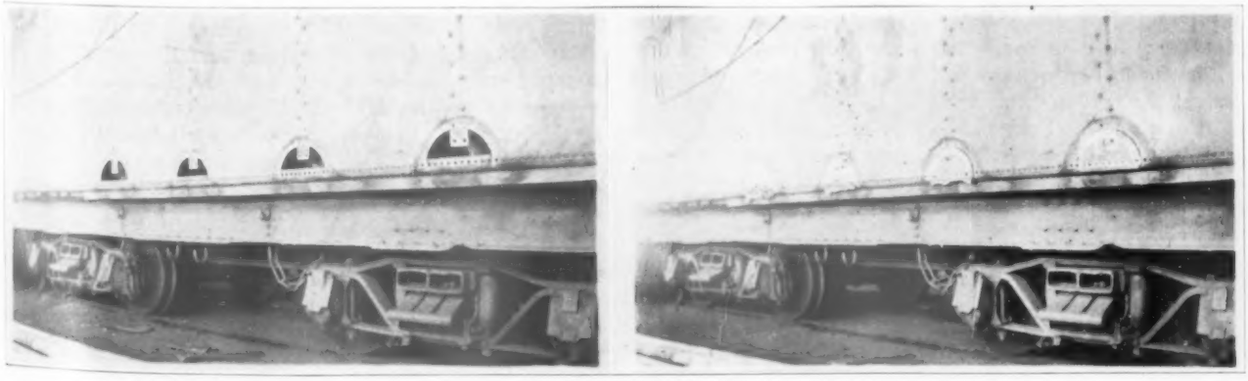
Weld the plate solid to the frame, then apply the welding material so it will form a 45 degree angle from the center to the edge, this will form the welding so it can be cleaned easily with the brush. After each filler rod has been applied, the brush must be used to remove all the slag deposited.

After the welding has reached the outer edge of the frame, a ½" rod should be added so it will extend one inch on each side of the weld.

When welding vertical members or between pedestal jaws, the small ratchet or screw jacks will answer the purpose, but when welding the horizontal frames, some are too large or the space is too small to allow the use of a jack to secure the expansion, then it must be obtained with the use of heat. This is obtained by bringing the frame to a dull red heat by using the acetylene torch. A box with both ends left open and which has holes punched in the bottom is placed around the heated part. Charcoal is placed in this box and the heat is allowed to be on the frame during the operation of welding, after which, it is removed and both frames are allowed to cool at the same time.

Excessive space between the edges to be welded is a common cause of weakness or failure in a welded joint. It must be remembered that the metal removed from the frames has

Welding Supervisor; Wabash R. R.



Patching Cracks at Bottom of T-Irons.

had mechanical treatment which gives it the ability to withstand shock and alternate stresses. The metal filled into the weld is of a cast nature and cannot be expected to have as good mechanical properties as the original metal. Only metal enough should be cut out to allow the proper manipulation of the arc.

In cases where the frame has broken in a weld and another process is to be used to re-weld it, the old welding should be completely removed.

Welding driving wheel spokes. Care should be exercised to get the expansion in a spoke in the same manner as for frames. The rim must be cut, the spoke beveled on one end to 45 degrees, cleaned off with the sand blast and then jack out the rim about ⅛ inch. After one side of the break has been welded, remove the jack and finish by welding the other side of the spoke. The rim will contract to its original position. All welds are reinforced about ¼ inch. This makes a permanent job and will eliminate flat spots over the welded spokes.

Coupler pockets. We weld an apron to the old type pocket so it will conform to the type as recommended by the ARA. This effects quite a large saving as the pockets cost $35.00 and the repaired ones cost $4.85.

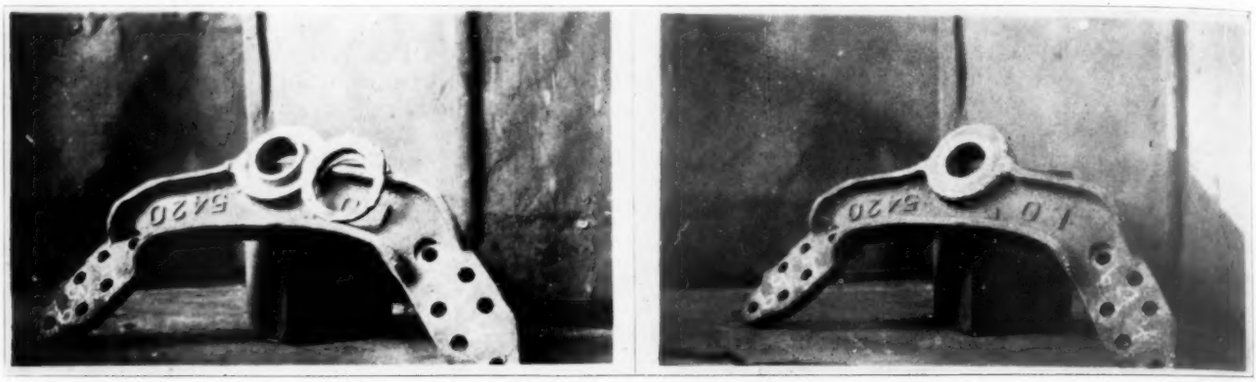
Trailer frame radius casting. This casting always wears very quickly and the only logical manner of repairing it is by welding. The bushing is pressed in and then a plate is placed around the bushing and welded. The engine truck radius casting and trailer equalizer casting is repaired by this method.

Tanks. In the past the method for repairing the tanks was to put a patch over the cracks which showed up at the bottom of the T irons. While that method made a tight joint it was unsightly. The tank as shown had riveted patches which were cut out with the torch. The edges were beveled with an air hammer, the patch put in place and held with three bolts, one at each bottom corner and one in the top center. The bolts are 1/16 inch smaller than the holes, this allows for expansion. When round patches are applied, they are belled out about ¼ inch to allow for expansion.

Taps. Quite a few men will be found in a large shop that do not know how to use a tap properly. They will either twist the tap in two or they will wear the wrench end round by using the wrong wrench. To offset this we braze a piece of machine steel six inches long on to the shank. This will twist before the tap will give, thus allowing the operator time to think that something is wrong. While we have had some twist off in the added piece ! haven't seen any break at the weld.

Welding Work on Fireboxes

When it is desired to weld a firebox without removing the back end, the welding edge should be prepared the same as on boiler sheets. Then bolt the sheets securely in place, taking care that there is a uniform opening of ⅛ inch all around the welding edge. Drill ½-inch holes, spaced about 14 inches apart, and use two pieces of ½-inch by 2x4-inch boiler plate on both sides of the sheet. Clamp with ½-inch machine bolts, being sure that all bolts are drawn tight. Rivet the top of the flue sheet to a point not less than 12 inches below the center of the crown, then start welding by using the back-step method, moving the clamps when necessary. Next weld the entire door sheet. All welding on riveted lap seams in a firebox should be applied to cover the entire edge of the sheet and should extend on the under sheet a width equal to the thickness of the top sheet.



Repair of Trailer Frame Radius Casting.

In welding around the door, cut outside of the first row of staybolts and trim the outside edge of the sheet just inside of the rivet holes. Bevel all edges to 45 deg. and fasten the patch in place, using the same method as the side method. Remove the row of staybolts adjacent to the patch and use a sand-blast to clean the edges. Weld by the back-step method. In renewing the upper part of the door sheet, cut out a patch allowing enough metal so that the line of the weld will come below the second or third row of staybolts. This will take care of contraction. Have all edges beveled to 45 deg. and use a sand-blast to clean the edges. Butt weld to the crown and side sheets. The sheets should be held in position by the same method as used for the side sheets. Weld by the back-step method. In welding the side sheets, cut the sheet 12 inches below the crown sheets. Remove all staybolts and rivets and also the adjacent row of stay-bolts in the upper sheet. Cut the door and flue sheet inside of the rivet holes and bevel each to 45 deg., place the sheet in position, using bolts in the mud-ring 1/16 inch smaller than the holes, and bolts in the top of the upper sheet with staybolts screwed in from the outside to force the sheet against the bolts to hold the sheet in position. Sand-blast the edges and weld the sheet at the top first, using the back-step method, then weld the door and flue sheet. Remove all bolts and rivets before the weld cools.

Where possible, all side sheet patches should be cut either in diamond or oblong shape. Never allow more than eight inches in the vertical seam, When applying such patches, allow sufficient bolts to hold the sheet in position with staybolts screwed in from the outside to force against the bolts. Remove the adjacent row of staybolts. Clean the edges by a sandblast and weld by the back-step method, using a mild steel electrode. Remove the bolts and staybolts before the weld cools.

For all leaky seams that are beyond calking, remove the rivets and cut the outer sheet on a line with the center of the hole. Bevel the sheet to 45 deg., sand-blast the edges and lap weld, filling the holes in the under sheet. This eliminates the renewing of the sheet that has worn edges. If a wrapper sheet is wheel worn 40 per cent or less, the worn place can be replaced by welding. Remove all staybolts in the section to be welded and clean off by using the sand-blast.

Then weld to the original thickness. Care should be taken to weld around all staybolt holes so they can be tapped out to full thread.

Flue Sheets

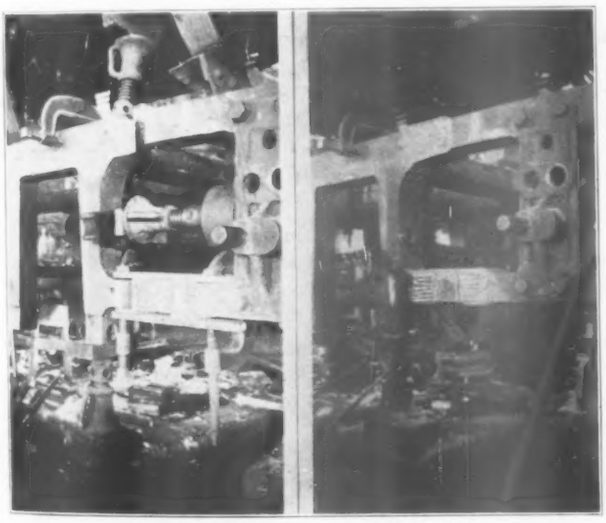
For the front flue sheet, the welder should use a cutting torch and cut the sheet at the knuckle. If the top of the sheet is in good condition, cut just above the top row of flue holes. If it is not in good condition, then cut out the entire sheet and bevel the edges to 45 deg. Place in position by using a strong back and tack weld around the sheet at points about 12 inches apart. Sand-blast the edges and weld by the back-step method, using a mild steel electrode as in previous operations.

In welding broken flue sheet bridges, it is best to cut the crack to 90 deg. and have a ⅛-inch opening at the bottom. Clean off with a sand-blast and drive an expander in the flue hole. Drive the expander out before the weld cools.

For a three-quarter sheet cut between the top of the staybolts and throat sheet braces and remove the top row of staybolts. If the crown and side sheets are in good condition, the flue sheet may be riveted. If not, then cut off behind the rivet holes and prepare the same as for welding a door sheet. Weld by the back-step method.

For a whole sheet if it is in good condition at the mud-ring, cut between the bottom row of staybolts and the mud-ring. This saves time and expense of removing the mud-ring rivets. Weld in the same manner as for a three-quarter sheet.

For a crack in the back flue sheet knuckle, bevel out the crack to 90 deg. from the water side, if possible. Sand-blast the edges and weld by the back-step method, using a mild steel electrode. The weld should be reinforced ⅛ inch on the fire side.



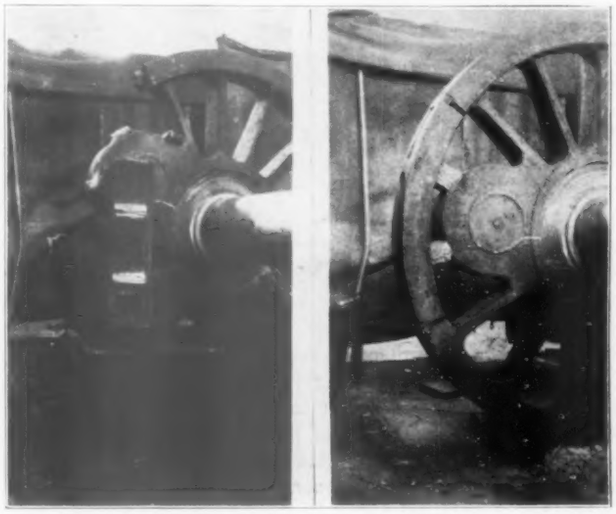
Locomotive Frame Weld.

In welding flues, have the sheet and flue beads cleaned off completely with a sand-blast, begin welding at the bottom center of the flue and finish at the top center. Never weld down on the side of a flue. Start welding at the top of the flue sheet and then finish each succeeding row before starting on the next. This will keep the heat down.

Repairing Mud-rings

For a mud-ring patch cut out all defective parts and remove the first row of staybolts adjacent to the cut. Bevel the edges of the sheet and patch and place the patch in position, using bolts 1/16 inch smaller than the rivet holes in the mud-ring. Use a sand-blast to clean and weld by the back-step method.

To prepare for the welding of a broken mud-ring remove enough from the bottom of the firebox plates to permit free movement of the welding tools. Vee out the mud-ring to 45 deg. on top side of the crack, leaving a ⅛-inch opening at the bottom and force open the fracture by driving in a small wedge. This will take care of the expansion. Clean off with a sand-blast and weld.



Repair on Driving Wheel.

TORCHWELD ANNOUNCES NEW GAS PREHEATER

A circular recently received from the Torchweld Equipment Company announces a burner for preheating by use of city gas. This burner is made of steel tubing, weighs about eight pounds and is 30½ inches overall. The inside of the burner proper is 2 inches in diameter by 12½ inches long. It is equipped with a brass gas inlet nozzle and adjustable air regulator controlling the regulation of the air volume to the amount of city gas used. It is in effect a strong, easily operated preheating torch burning either artificial or natural gas for use wherever heating or preheating of any kind is done. The price of the complete outfit is $10.00.

OXYGEN PRODUCTION ON THE INCREASE

An encouraging increase in facilities for producing oxygen is noted in reports received this month from the office of the Keith Dunham Company, Chicago. The Vegetable Oil Products Company have recently put into operation an Oxeco liquefaction oxygen producing plant with a capacity of 1,000,000 cubic feet per month. This is the fifth plant of this type on the Pacific Coast. The Carbo-Oxygen Company recently put into operation at Coraopolis, Pa., a producing unit with a capacity of 1,000,000 cubic feet per month. The Burdett Oxygen & Hydrogen Company, Pittsburgh, Pa., have recently increased their oxygen production by installing an additional liquefaction column with a capacity of 1,000,000 cubic feet per month. A second unit was recently installed at the plant of the Ohio Electrolytic Oxygen Company, Cincinnati.

POSTER FOR WELDING SHOPS

A poster for welding shops to use in advertising their trade to customers and callers at the shop has recently been prepared by Smith's Inventions, Inc., Minneapolis, Minnesota. This poster is printed in colors and carries the slogan "Save the Pieces! We'll Weld Them Together." The Service Department of Smith's Inventions state that they will send these without charge to welding shops on request.

High Purity Oxygen Cutting Tests*

Results of Laboratory and Field Tests Indicate Increased Efficiency as Purity Percentage Approaches 100%

By J. J. Crowe†

THE question naturally arises what benefits are to be derived from small increments in purity as we approach the ultimate limit of 100 per cent oxygen and to answer this question the Air Reduction Sales Company has carried out two series of experiments extending over a period of several years, and it is the results of these experiments which are presented in this paper.

The experiments were made on steel plates and rolled steel billets, ranging in thickness from ⅜ inch to 12 inches. To eliminate the human element or personal equation as far as possible, all the cutting alone in the first series was done with a hand torch mounted on a machine (Radiagraph) geared to give variable speeds from a few inches per minute up to 60 inches or more per minute, and in the second test series the cutting was done with a machine torch mounted in the same manner (See Fig. 1.)

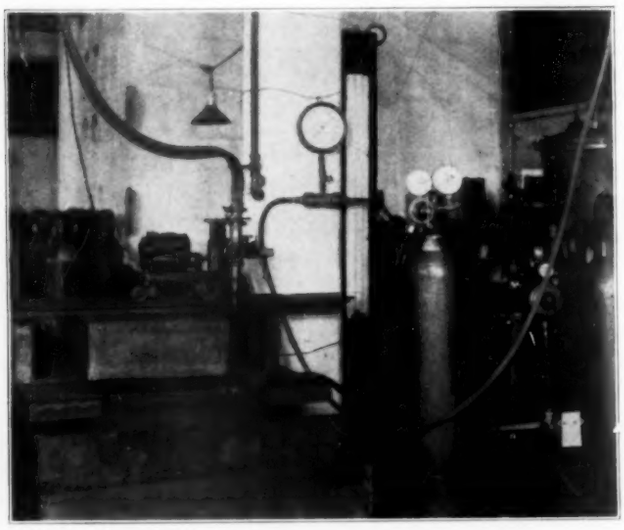


Figure 1—Oxygen Testing Apparatus at Work.

The speed of the Radiagraph was checked with a stop watch. The pressures, when practicable, were measured with mercury manometers, and the higher pressures were measured with standard test gauges, frequently calibrated and tested on a dead weight gauge tester. The gas (oxygen and acetylene) consumptions were obtained by weighing the cylinders before and after using, on scales accurate to ¼ ounce, and these weights were checked up making up the loss in weight with shot and then weighing the shot on a separate balance.

All the material was cooled to approximately the same temperature before cutting, and in short the experiments were carried out under laboratory conditions in which every possible variable was controlled as closely as possible.

The laboratory was furnished with an ample supply of oxygen varying in purity from 98.5 per cent to 99.5 per cent by steps of approximately ¼ per cent for the first series and from 97.5 per cent to 99.5 per cent by ½ per cent steps for the second series.

The actual purities were determined at the time of manufacture, and were carefully checked in the laboratory by the method described in the appendix.

Previous experiments in which oxygen of various purities manufactured by the electrolytic process compared with oxygen of the same purities manufactured by the liquid air process had shown no measurable difference.

In the typical graphs shown in Figs. 2 and 3 the minimum pressures required to cut the 6-inch and 12-inch thicknesses have been plotted against the purity of the oxygen used. To determine these pressures a large number of preliminary cuts were made on each thickness of metal with oxygen of each purity. The method of procedure followed was to start with a pressure that would make the cut without difficulty, and then to reduce the pressure by stages until the minimum pressure was found that would just make the cut.

Preliminary experiments were also made to determine the most economical size of tip and the speeds to use in making the final cuts. The curves shown are concave upwards but only slightly so, and this is typical of all curves plotted in this manner.

Taking Fig. 2 as an example, it will be noted that the pressure required to cut a billet 12 inches thick using oxygen of 99.5 per cent purity was 99 pounds per square inch, whereas it required a pressure of 112 pounds when the oxygen purity was reduced 0.5 per cent—99.0 per cent—and if the purity was dropped to 98.0 per cent the pressure required was increased to 142 pounds.

As the cutting tip was the same for all cuts on the same thickness of metal the oxygen consumption for the same amount of cutting increases with the pressure required to make the cut.

The next series of curves, Figs. 4 and 5, show the number of cubic feet of oxygen of the various purities required to cut one linear foot of the metal thickness given on each curve. The consumptions given correspond to the lowest possible pressures it was found possible to use.

In order that the data obtained may be more easily compared they have been tabulated in Table I after reducing to a common basis, that is, the number of cubic feet of oxygen of the various purities required to cut metals of the various thickness, using 100 cubic feet of 99.5 per cent oxygen as a standard of comparison. The mean of the results given in the table are shown graphically in Fig. 6.

It will be noted that 11.9 per cent more oxygen of 99.0 per cent purity is required to do the same amount of cutting as was done with oxygen of 99.5 per cent purity, and when the oxygen purity was dropped from 99.5 per cent to 98.5 per cent the increase in consumption was 29.2 per cent. In other words, it required 129.2 cubic feet of 98.5 per cent oxygen to make the same length of cut as was made with 100 cubic feet of oxygen having a purity of 99.5 per cent.

The preceding data have shown how the oxygen consumption increases with decrease in oxygen purity without reference to time. The results of time studies made in the first series of experiments on sizes up to 4⅜ inch thickness are given in Table II. Owing to the large amount of material involved, these experiments were not extended to cover the larger sizes, all the cutting on the 5-inch

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**Abstracted from a paper presented at the February 16 meeting American Welding Society, New York City.*

†Engineer in charge Apparatus Research and Development Department, Air Reduction Sales Company.

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and 12-inch thicknesses being made at constant speed. The actual time to make the various cuts is shown in Table II and in order to compare the results they have all been reduced to a common basis and expressed in percentages using the time obtained with 99.5 per cent purity oxygen as a standard of comparison.

The loss in time expressed in percentages very closely approximates the waste in oxygen as the purity decreases, and the two go together, that is, as the oxygen purity decreases, the time required to make a given cut goes up as shown in Table II, and the consumption of oxygen in making the cut goes up at the same time as shown in Table I. The average of the results expressed in percentages as shown in Table II is shown graphically in Fig. 7.

The characteristic drags obtained on the 12-inch billets with oxygen of four different purities are given in Fig. 8. For some work, such as straight line cutting, the amount of drag may not be of serious consequence, but in machine cutting of intricate shapes the drag must be maintained at a minimum as otherwise the underside of the shape cut will not register with the top side.

To decrease the drag to correspond with that obtained with the high purity oxygen (99.5 per cent) it would be necessary to greatly increase the pressures and it follows that the consumptions for the lower purities would be much greater than those shown in the curves and tables.

M. Piette, in carrying out an elaborate series of experiments[1] to determine methods of eliminating oxygen waste, selected oxygen having a purity of 96 per cent as representing the lower limit of oxygen purity used in France. The results obtained by M. Piette with oxygen of 96 per cent purity have been plotted in Fig. 9, and the corresponding results obtained by the authors with 99.5 per cent oxygen have also been plotted to the same coordinates. The average of the results show that it requires 251 cubic feet of 96 per cent oxygen to do the equivalent work done with 100 cubic feet of 99.5 per cent oxygen.

The Bureau of Standards, Washington, D. C., as stated in a paper[2], published under date of December 28, 1921, decided to use oxygen of 98.3 per cent purity as best representing the average purity available at that time. The Bureau of Standards found that the range of purity was 97.2 to 99.3 per cent.

It was not the purpose of this investigation to enter into any considerable number of practical applications in cutting with high purity oxygen and the results obtained, but anyone interested can easily demonstrate the superior cutting properties of high purity oxygen by making simple and practical tests, if they will obtain oxygen of, say, 99.5 per cent purity and oxygen of 99.0 per cent purity or less and make cuts in the same steel plate or forging with both oxygens.

If the cutting pressures are held equal and constant it will be found that there will be a very appreciable difference in the speed of cutting, that is, if the pressures are held equal the length of cut in a given time will be considerably greater for the oxygen having the higher purity. It will also be found that if the speeds of cutting with both qualities of oxygen are held constant and equal that a much lower pressure can be used with the oxygen having the higher purity, and still maintain the cut. Thereby the consumption is reduced, that is, by holding the speeds

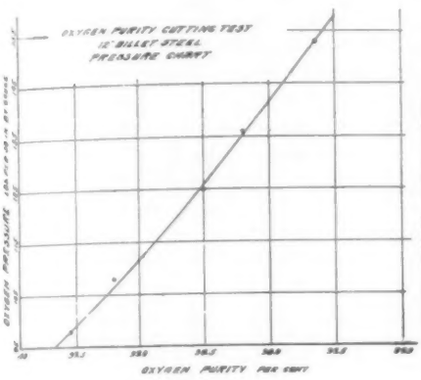


Fig. 2.

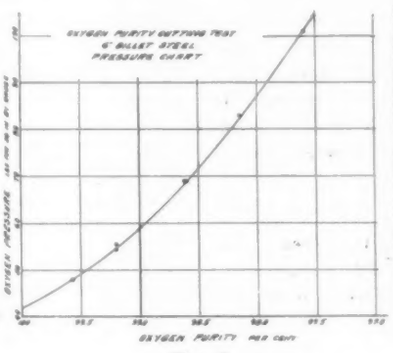


Fig. 3.

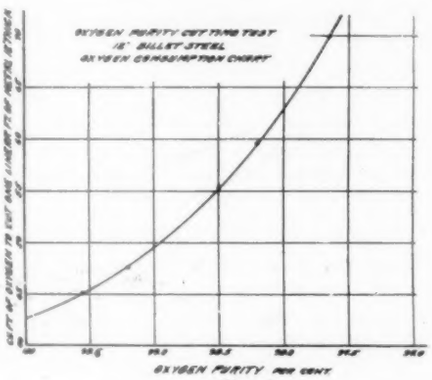


Fig. 4.

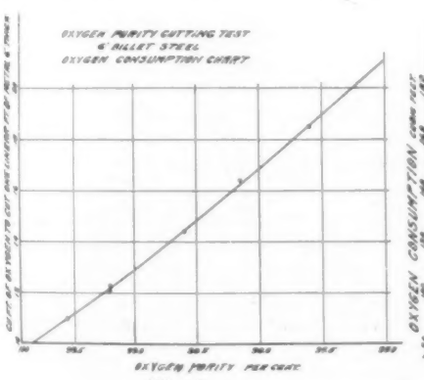
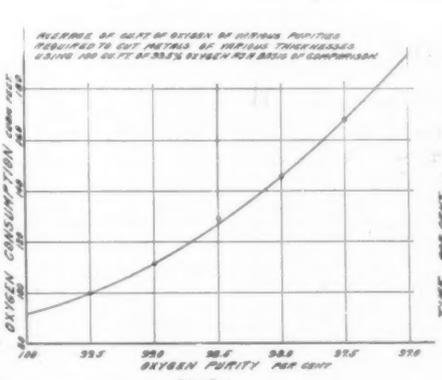


Fig. 5.



Figfl 6.

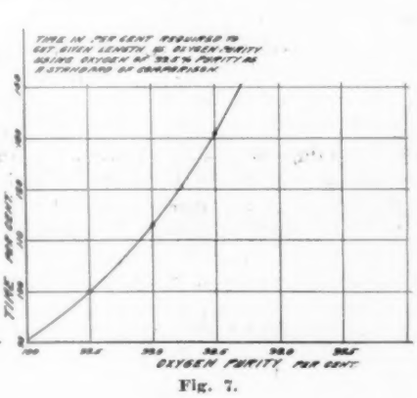


Fig. 7.

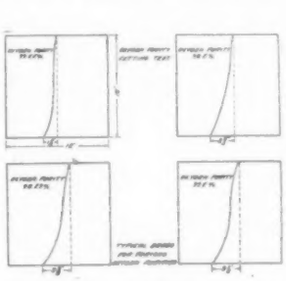


Fig. 8.

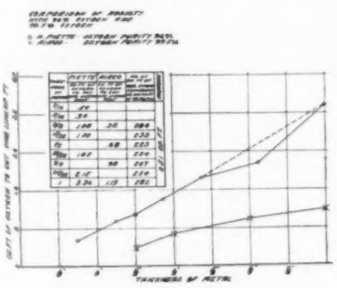


Fig. 9.

[1] *Eliminating the Oxygen Waste, The Welding Engineer, Volume 9, No. 12, Page 25.*

[2] *An investigation of oxyacetylene welding and cutting blowpipes, with special reference to their designs, safety and economy in operation by Robert S. Johnston, Bureau of Standards Technologic paper No. 200.*

the same and properly adjusting the cutting pressures which will be different for each purity, a considerable difference in oxygen consumptions will be shown in favor of the higher purity.

As a field check on the investigation made in the laboratory, a large number of oxygen cylinders analyzing 99.5 per cent and an equal number of oxygen cylinders analyzing 99.0 per cent were used for wrecking steel cars, and a careful study was made of the results obtained with the two oxygen purities. Ten cars were scrapped with each purity of oxygen, and to eliminate as far as possible the personal equation the operators were frequently changed from one oxygen purity to the other, and at no time were the operators informed as to the purity of the oxygen supplied them. Weather conditions were bad, the temperatures ranging from —30 degrees F. to +21 degrees F. and the cars were covered with snow. Working under these conditions and with operators some of whom had only a limited experience in oxy-acetylene cutting, a saving of 10 per cent was shown in oxygen consumption and 11.2 per cent saving in time, both in favor of the oxygen having a purity of 99.5 per cent.

Conclusions

1—That small increases in oxygen purity greatly increases the efficiency of cutting operations, both as measured by oxygen consumption and by time required to complete a given amount of cutting.

2—That the difference of effect of small increases in oxygen purity decreases as 100 per cent purity is approached, but the effect is of considerable magnitude for the interval of 99.0 per cent to 99.5 per cent oxygen purity showing a saving of approximately 12 per cent for oxygen consumption and an equivalent saving in time.

3—That decreases in consumption and time with small increases in oxygen purity found by the laboratory have been substantiated by practical applications made with oxygen of 99.5 per cent and 99.0 per cent purity.

OXYGEN PURITY TESTING*

By F. P. Gross, Jr.†

As previously stated, the procedure in making an oxygen analysis is simple. It consists in taking a certain volume of the gas representing 100 parts, removing all the oxygen and then measuring the volume of the residue. One hundred parts minus the residue gives the volume of oxygen present in the original sample, or, the parts of oxygen in 100 parts of gas, that is the oxygen content in per cent. Hence we have the per cent purity of the gas tested in terms of oxygen. And so we speak of the purity of ordinary commercial oxygen. An oxygen sample testing 99.5 shows a residue of gas other than oxygen of 0.5 per cent.

The apparatus required must consist of two essential parts—one to measure the sample, and the residue or impurity accurately, and the other to remove the oxygen only without absorbing any of the impurities. The measuring part is the burette and the oxygen absorption part is the pipette. With this apparatus at hand we have a burette—the measuring device—that is both convenient and accurate. It is graduated or marked in such a way that very close and accurate readings may be obtained, being divided into 1/100 of 1/100, or 1/10000 parts of the original volume. This minute graduation is obtained by shaping the burette so that the residue to be measured is contained in the small diameter stem.

The human eye can easily read, say, lines 3½ inch apart. Now if we draw two lines approximately that distance apart on a cylinder of large diameter we have a much greater volume enclosed than between two similar lines on a cylinder of smaller diameter. The larger the volume read, the greater the error involved by one division. Here in this apparatus we have the stem of the burette of small diameter so that the space between two divisions, or graduations, represents only 1/10000 part of the whole volume measured. In the lower portion the burette is of much wider diameter so that it will not be unnecessarily long. No readings are ever taken in this portion, of course, and so no chance for error is introduced. It is on the stems at either end of the bulb that the readings are always made.

The burette holds 100 milliliters, or cubic centimeters, or just simply 100 parts mentioned previously. Hence we have the piece of apparatus so finely graduated that the purity reading may be made to 1/100 of one of these parts.

Not only must the readings be thus easily taken, but the markings on the burette must be calibrated and etched so as to be accurate. The calibration is done in a certain definite way as with all chemical measuring apparatus where accuracy is essential.

The pipette, or oxygen absorbing device, contains metallic copper in small coils to insure large surface and a solution consisting of NH_4OH (ammonium hydroxide, ammonium hydrate, or aqua ammonia) and NH_4Cl (ammonium chloride or sal ammoniac). This absorbs the oxygen efficiently by first oxidizing the copper and then dissolving the oxide film in the solution.

TABLE I

Oxygen Consumption of Various Purities Required to Cut Metals of Various Thicknesses, Using 100 Cubic Feet of 99.5 Per Cent Oxygen as Basis of Comparison.

Thickness of Metal Inches	Series No.	OXYGEN PURITY				
		99.5 Per Cent Cu. Ft.	99.0 Per Cent Cu. Ft.	98.5 Per Cent Cu. Ft.	98.0 Per Cent Cu. Ft.	97.5 Per Cent Cu. Ft.
⅜	1	100.0	114.1	125.5	.....	.....
½	1	100.0	111.1	121.5	.....	.....
¾	1	100.0	116.0	140.0	.....	.....
1	1	100.0	115.4	135.0	.....	.....
2½	1	100.0	108.0	123.4	.....	.....
2½	2	100.0	112.1	127.5	148.8	173.9
4¾	1	100.0	113.3	141.5	.....	.....
6	1	100.0	108.8	133.6	.....	.....
6	2	100.0	114.8	131.7	150.1	169.3
12	1	100.0	108.4	119.5	.....	.....
12	2	100.0	108.9	122.0	139.0	161.0
Average Cons.		100.0	111.9	129.2	145.9	168.1
Difference for each ½ per cent decrease in oxygen purity.....			11.9	17.3	16.7	21.5

TABLE II

Actual time required to make cuts of given lengths of metals of various thicknesses using oxygen of various purities and time expressed in percentages using time required with oxygen of 99.5 per cent purity as a standard.

Thickness of Metal Inches	OXYGEN PURITY											
	99.50%			99.25%			99.00%			98.75%			98.50%		
	Time to make cut Min.	Sec	Per Cent	Time to make cut Min.	Sec.	Per Cent	Time to make cut Min.	Sec.	Per Cent	Time to make cut Min.	Sec.	Per Cent	Time to make cut Min.	Sec.	Per Cent
	74	18													
⅜	42	15	100	79	51	107.3	84	45	114.0	91	30	123.1	93	24	125.5
½	35	45	100	43	13	102.3	46	54	111.0	48	42	115.2	51	15	121.3
¾	35	20	100	38	3	106.4	41	27	115.9	48	48	122.5	50	5	140.1
1	26	7	100	37	18	105.6	40	45	115.3	43	0	121.7	47	39	135.0
2½	14	29	100	27	4	103.7	28	12	108.0	29	40	113.7	32	14	123.5
4¾			100	15	25	106.5	16	25	113.4	18	32	128.0	20	27	141.3
Mean	.....	.....	100	.....	.....	105.3	.....	.....	112.9	.....	.....	120.7	.....	.....	131.0
Difference for 0.25% in oxygen purity.....				5.3%			7.6%			7.8%			10.3%		
Difference for 0.50% in oxygen purity.....				12.9%						18.1%					

Presented at the February 16 meeting of the American Welding Society, New York.

†*Air Reduction Sales Company, New York.*

Electric Resistance Welding*

Hints on Preparation of Materials and Operation of Spot Welding Machinery to Get Maximum Efficiency

By Frank M. Cushing†

THERE are two classes of electric welding, namely arc and resistance, and though the latter is not generally known or understood it is used much more extensively than the other process of welding. However, its use is confined to the manufacturing industries almost exclusively. Resistance welding is sub-classified into three distinct and separate forms, Spot, Butt and Seam Welding, each using the same methods and principles, but restricting their use to entirely different mechanical means; in each case two elements exist alike, and these are pressure and current.

For the benefit of those readers who are not familiar with the resistance welding process it will be advantageous to give a general idea of its principles at this time, and the writer will deal with the spot welding method in this article.

Spot welding is accomplished by mechanical means, and the operation of these machines is very simple. A large volume of amperage is carried through copper electrodes at a very low voltage (from two to four volts), and the heat is generated by the resistance set up by the material to be welded, causing it to become plastic at the point of contact the instant the current is applied, at which time sufficient pressure must be exerted to force the semi-molten metal together so as to form a homogeneous union. One of the features of this form of welding is that the greatest resistance is set up at the point where the two metals come in contact with each other, and therefore the inner surfaces are brought to a welding heat before the outer surfaces reach that heat; consequently if the outer surface is heated to a welding temperature it is certain that the interior surfaces are also at a welding temperature. These operations are all accomplished automatically by somewhat different mechanical means in different types of machines.

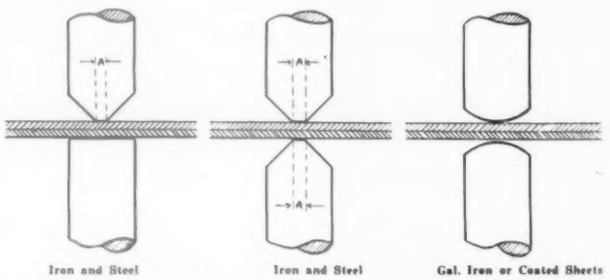
The metals to be welded must be brought into intimate contact at the point of welding and must be held securely during the time the current is applied, and also sufficiently long enough thereafter to allow the weld to "set" before removing from the machine. This is all done in a fraction of a second in less time than it takes to tell.

While spot welding machines can be operated successfully by unskilled labor, there is a certain amount of attention necessary if perfect welds are to be made over a long period of time, and a casual observation on the part of the foreman will eliminate a great deal of trouble and also increase the output of each machine.

The most common trouble arising in spot welding—and this also applies to all other forms and processes of welding and brazing—is the use of dirty, rusty or scaly material. Practically all metals can be welded, included cold rolled steel, auto body steel, black sheet steel, angle iron, bars, wire, German silver, galvanized iron, terneplate, tin, monel metal and some grades of brass, malleable iron and forgings. It is necessary, however, that the metal be as clean as it is practical to make it, and if possible heavy sheets of black iron should be pickled and small parts rattled or tumbled if best results are to be secured. Heavy scale on black sheets or bars causes poor welds and an excessive amount of wear on the electrodes, caused from pitting, which requires them to be filed at frequent intervals.

Pressure is the next important element which must be considered and too much emphasis cannot be placed on this particular function. The heavier the metal the more pressure is necessary, especially where the metal is somewhat scaly. Where an excessive amount of sparks fly from the weld it is a sign that too little pressure or too much current is used, and this must be regulated accordingly. In welding galvanized iron, brass, tin and coated stocks less pressure and more current are required.

The shape and care of electrodes is another element which must be given attention. It is a common fault to allow the electrodes to become worn down so that the point of contact is too large and the size of the weld is not confined to a small enough area. On the general run of work the upper electrode



Iron and Steel | Iron and Steel | Gal. Iron or Coated Sheets

Gauge	Dia. of A	Gauge	Dia. of A.	
28-26-24-22	1/8 inch	11-10	1/4 inch	3/4-inch radius on 1-inch electrode.
20-18-16	5/32 inch	9-8-7	5/16 inch	Rounded electrodes can be used to advantage on practically all metals.
14-12	1/4 inch	6-5-4	3/8 inch	

should be 1/8 to 3/8 inch in diameter and the lower electrode somewhat larger, and where no indentation is desired the work should be placed in the machine so that the outside surface is in contact with the larger surfaced electrode. In welding galvanized or coated stock the electrodes should be rounded. The accompanying illustrations will more clearly show the sizes and shapes of electrodes used for the various materials and gages.

Water-cooled electrodes should be used whenever possible, as they will retain their shape for an indefinite period of time and require less attention than the plain solid electrodes. Water is forced to within one-half inch of the welding point, and this constant flow of water keeps them cool and prevents them from annealing. Where the electrodes become heated from being in contact with the molten metal, they become annealed and soft and are easily pitted up and wear down so that considerable filing is necessary in order to keep the point to the proper size and shape. Where it is impossible to use a water-cooled electrode, the horns or carrying arms should be water-cooled, especially where the welder is used on production work requiring constant operation. All modern types of spot welders are equipped with the water-cooled electrodes, and water-cooled horns can be obtained from the manufacturers at small additional cost.

Dirt, grease and scale are non-conductors, and at the low voltage employed in welders it takes very little of the above to make a poor contact. If dirt and scale are allowed to gather around the sockets and holders a poor contact will be the consequence and they will become heated at these points. Therefore, it is sometimes necessary to clean all the sockets and joints so that no resistance is set up at these connections, which if allowed to become too resistant will consume not only more current but retard the speed of the operation and consequently poor welds will be the result..

As stated in the beginning of this article it is necessary that the pressure be maintained throughout the welding process, and when the metals are not in intimate contact when the current is applied, or in other words, the current is applied before the

Courtesy Western Machinery World.

†Engineer Acme Electric Welder Company, Los Angeles.

REGO Valves Stop T

THE PORTLAND OXYGEN & HYDROGEN COMPANY

OXYGEN 99.5% PURE HYDROGEN 99.9% PURE
PUROX COMPRESSED ACETYLENE
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PORTLAND, OREGON

April 10,1925.

Bastian-Blessing Company,
240 East Ontario Street,
Chicago, Ill.

Gentlemen:

Knowing as we do the appreciation felt by a Manufacturer for unsolicited letters from customers approving of the Manufacturer's product, we take pleasure in advising you of the great relief we have experienced since we adopted your oxygen cylinder valve about a year ago.

For eight or nine years we had tried the product of other valve Manufacturers and had about come to the conclusion a constant loss in gas and goodwill of customers was inevitable due to valves leaking after they had left our plant. Your valve #962 equipped as it is with Monel metal stems and produced with great accuracy and apparent good workmanship, has shown us that our previous years' experiences were nightmares rather than an inevitable feature of the oxygen business. Personally I am inclined to credit good workmanship with the satisfactory results we are getting from your product as there are other Manufacturers making valves closely resembling the one you make.

Yours truly,

THE PORTLAND OXYGEN & HYDROGEN COMPANY

By E. [illegible]

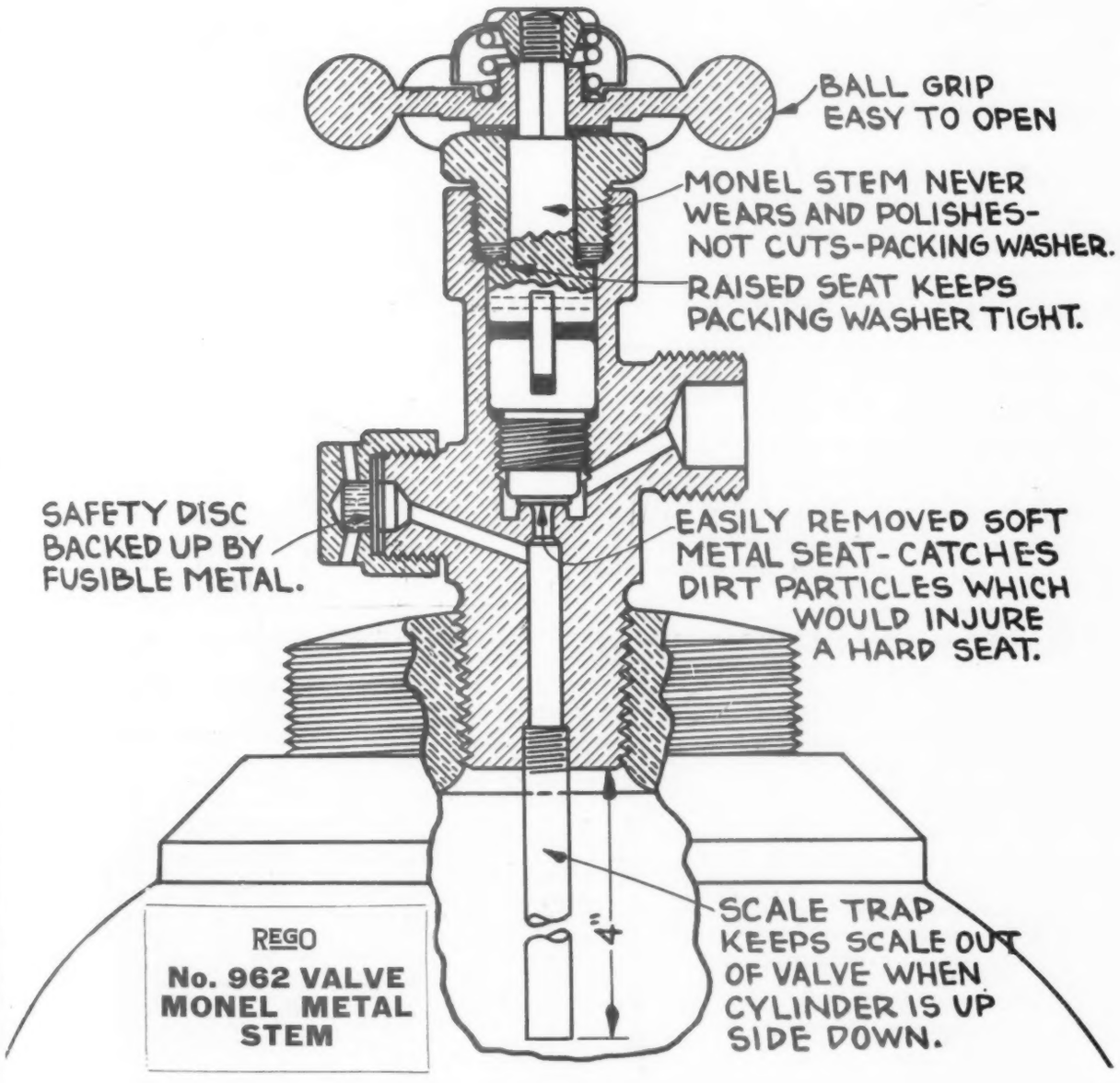
President

EYP-S

WELDING and CUTTING SUPPLIES OF ALL KINDS

Tse Costly Gas Leaks

HERE'S WHY



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metals are not firmly together, an arc will be formed when the two pieces touch and a hole will be burnt through the two pieces. This is easily adjusted by bringing the electrodes closer together or making such other adjustments as are provided for in the machines. It must be borne in mind that every time a weld is made the circuit breaker operates, and while they are so constructed as to eliminate any perceptible amount of arcing they should be filed off occasionally, removing the pit marks where the two poles meet.

On most modern spot welding machines convenient adjustment regulators have been provided so that all adjustments can be made instantly and accurately.

To the person unfamiliar with the operation of a spot welder it will seem that considerable attention is necessary for the successful operation of these machines, but when you consider the many thousands of welds which are made without any attention whatever and the speed with which these machines are operated the attention to be given is negligible. It is not at all uncommon to make from fifteen to twenty thousand welds per day on a foot operated machine, and this can be greatly increased on the power operated types.

There is not the slightest danger in operating a spot welding machine as the current is transformed within the machine from a high to a very low voltage—so low, in fact, that by holding the hands on the horns or electrodes while the machine is in actual operation not the slightest sensation can be noticed.

Practically all the small spot welders, up to the 15-kilowatt capacity, are foot operated, but the heavy duty machines are provided with both hand and foot operating mechanism, hand operated types being preferable. On this type of machine the current is applied through the thumb button in the handle of the pressure lever which actuates the current in the welding transformer through a magnetic switch.

Spot welding while greatly used in just in its infancy, and it is only a matter of a few years until every sheet metal working shop will be equipped with these labor saving devices. The lines of industry in which spot welding machines are now used are very diversified, ranging from concrete works to corset factories and covering every metal and wire working industry.

OIL STILL REBUILT BY ARC WELDING

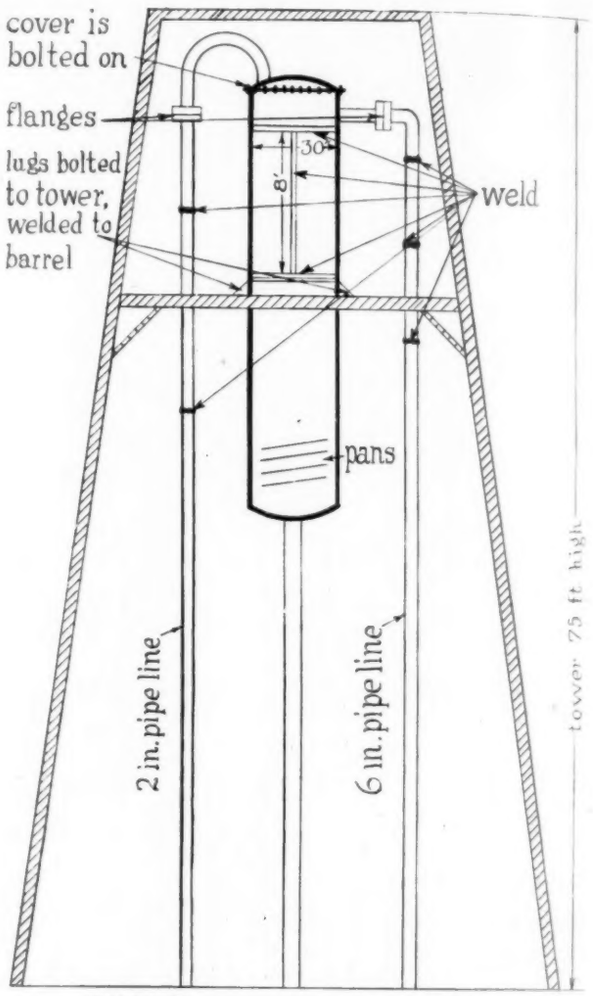
By S. J. Melville

Perhaps a short description of a very difficult arc-welded job recently done here by the company with whom I am connected may be of interest to some of your readers.

It consisted of an 8-foot extension to the dephlegmator of a high pressure cracking oil still. The work was done in February under very trying weather conditions, the average temperature being from 10 deg. above to 6 deg. below zero, about 75 feet above the ground, and the wind blowing next to a gale a great part of the time. The dephlegmator was cut 1 foot below top flange and new addition inserted. The addition was 30-inch diameter by 8 feet by ⅝ inch thick. Boiler plate was rolled to size, single-veed 90 deg. and welded in and outside, using 5/32-inch and ⅛-inch mild steel electrodes. Weld made in two courses intermittent and reinforced ⅛ inch. Two supporting lugs welded to shell and three welds made in 6-inch and two welds in 2-inch pipe lines. Tested to 150 lbs. pressure with hot oil and was perfectly tight. Has been in operation since at 100 lbs. pressure at 600° F. and with the smallest leak there would be danger of an explosion, with possible destruction of three adjoining stills The inside welds were made in a swing-chair with block and tackle, as it was impractical to put up staging.

The accumulation of carbon inside gets to a red heat, so altogether the conditions called for a 100 per cent job, which I am glad to say, we put over. There were several all-welded pans of a new type made of ¼-inch plate put down inside of shell. Lugs were made from ½-inch plate 8 inches long, but to L angles with piece to fit and welded all around, welded to shell and bolted to tower supports.

I think the service the weld has to undergo is sufficient proof of the reliability of welding on high pressure vessels under exact-



High Pressure Cracking Oil Still

ing service to warrant more general use of the process than is at present allowed.

As a rivet salesman only recently remarked to me, "You fellows are sure putting the skids under us."

ANNUAL SPRING MEETING OF THE AMERICAN WELDING SOCIETY

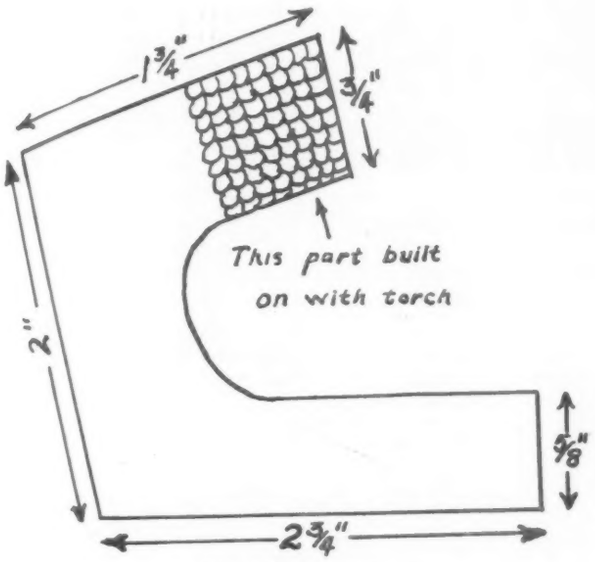
Good attendance and favorable weather conditions both helped to make for the success of the Annual Spring Meeting of the American Welding Society which was held in New York, April 22, 23 and 24th. It was the sentiment of the meeting that progress made so far was highly satisfactory and that activities of the Society should proceed along the same lines as before.

The first day was entirely given over to meetings of the Resistance Welding Committee, the Gas Welding Committee, the Electric Arc Welding Committee and the Educational Committee. On the morning of the second day a business session of the Society was held and this was followed in the afternoon by an inspection trip to the plant of the Standard Oil Company of New Jersey. About eighty men were present for this trip and upon arrival at the plant they were divided into two groups to make it easier to accomplish a thorough inspection of the applications of gas and electric welding processes throughout the plant. On the return trip a stop was made for an inspection of the Electric Arc Cutting & Welding Company plant in Newark. There was just time to get back to the city in time for the annual dinner which was held at the Park Avenue Hotel. Friday morning and part of Friday afternoon were given over to a technical session of the Society. At this session a great many papers on different phases of welding and the applications of welding were read by members of the Society. The program closed with the meeting of the American Bureau of Welding and of the Board of Directors of the Society.

REPAIRS ON A TRACTOR BLOCK

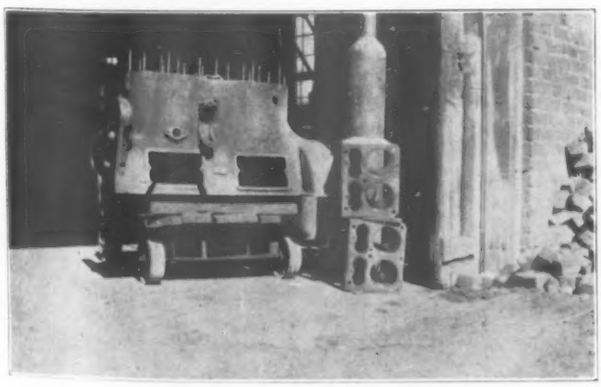
A. W. Brueggemaun, Enid, Okla.

The accompanying photo shows an interesting welding job I did on a large tractor block without preheating. The section marked on the photo, which is covered by the inspection plate, was broken and lost. I found a piece of an old engine base in the scrap pile and by building up a rib on this it answered the purpose fairly well. I then planed the two sides of the piece to the exact shape and welded it on one end just enough to hold it in place. The other end was welded completely and then allowed to cool. When cooling, the end just tacked in place, cracked. I let it get entirely cold and the break was then about ½ inch open. Then I took a ⅞ inch bolt, set it across the opening in the case, and crowded the break open to ⅛ inch.



How Job Was Done

I used a large tip and made the weld as quickly as possible. As soon as the welding was done, I started to release the tension on the bolt slowly until it was entirely released. Care, however, must be taken to keep the tension screw cold or one may set up too much stress with the added expansion in the bolt heating up. Either loosen the tension slightly, or keep it cool with water and asbestos. I prefer the latter, as this takes the guess work out of your mechanical expansion. I have used this scheme on numerous jobs in crank case welding and have been very successful.



Block Showing Location of Fracture

I haven't the exact cost of this welding job, but one can readily see it can be done with a great saving to the owner as well as being a profitable job for the welder.

The two smaller cylinder blocks in the pictures have a 5-inch bore. Both were badly pin scored and one was broke through into the water chamber. I preheated the cylinders and welded the scores with cast iron filler rod, then reground same on a cylinder grinder to ⅛ oversize. The welding was only noticeable in the different color of the grey iron.

NEW OXWELD PORTABLE GENERATOR

A new 35-pound portable low pressure acetylene generator of the carbide to water type has just been put on the market by the Oxweld Acetylene Company, Long Island City, New York.

This generator has various characteristics of design and operation which make it readily adaptable to practically all conditions wherein the oxy-acetylene process might be used.

Completely assembled, the generator is only 56 inches high. The outside diameter is only 24 inches. The shipping weight is 320 lb., and the net weight empty, 210 lb. Fully charged with carbide and water the machine weighs 530 lb. The carbide charge is 35 lb., equivalent to about 157½ feet of acetylene per charge. The generating capacity is amply sufficient to supply a No. 15 Oxweld welding head, and, if occasion demands, the generator will stand an overload of 300 per cent without hindering operation. It can be cleaned, recharged with water and carbide, and purged in less than 15 minutes, if water is supplied from an ordinary garden hose.

Large, strong handles are provided for carrying the generator. These are so designed that they can be used either as hand holds, or in connection with poles.

Working tests have been conducted in which this generator has been tipped to an angle of 10 degrees. No matter in what direction tilted, the operation remains as satisfactory as when the generator stands level. Incidentally, a tilt of 10 degrees involves raising the high edge 4¼ inches. No one would be likely to tilt a generator 4¼ inches and try to use it. Further than that, the generator fully charged with water and carbide will right itself when tilted to an angle of 30 degrees. Because of its low pressure design, which provides a maximum of safety under all conditions, the generator, even if upset, may easily be righted and put back into operation.

To take care of the possibility of slight after-generation, a vent is provided which relieves at approximately 26 inches water pressure. This is below the 1-pound limit set for low pressure generators.

To prevent operation by unauthorized persons, a padlock is provided which can be locked through the hole in the plunger of the charging door. This padlock is chained to the generator, so that it will not become misplaced or lost.

The shell, top, bottom and partition are of 18 gauge galvanized sheets. An angle iron is placed across the bottom for stiffening. The feed lever, feed lever bracket, and charging door cross bar are made of cast steel, to avoid possibility of breakage. The carbide charging door and hopper cover are cast iron. The regulator castings are of a special composition. All parts subject to corrosion are galvanized or sherardized. Where galvanized sheets have unprotected edges, they are regalvanized.

CONNECTICUT WELDERS MEET

The second meeting of the Westchester and Connecticut welders was held recently at Getters Inn, Manaroneck, at which all the leading job welding shops in these parts were represented. The purpose of this meeting was to organize an association of the job welding shops. Before the evening was over, plans for organizing the Master Welters' Association were under way.

Mr. O. W. Adams, the Connecticut representative of the Lincoln Electric Company at Cleveland, was elected honorary president. Mr. Steck of Mt. Vernon, was elected secretary and treasurer. A committee of three was appointed to draw up a constitution and set of by-laws. This committee consists of Mr. J. C. Clarke of Stamford, Mr. R. L. Hibbins of New Rochelle, and Mr. Steck.

During the course of the evening many interesting problems, both technical and practical, were discussed at considerable length, which made the evening enjoyable as well as profitable. All present were most enthusiastic over the idea of having an association which will make for better welding, and for the upbuilding of the trade in general, and all are looking forward to the next meeting with a feeling that something really constructive has been started.

The Welding Engineer

Founded by L. B. Mackenzie, 1916

Reg. U. S. Pat. Office.

Published on the 17th of Each Month by

THE WELDING ENGINEER PUBLISHING CO.,

608 S. Dearborn St., Chicago, Ill

Telephones Wabash 7134 and 7140

G. H. Mackenzie.....President and Treasurer

W. W. Brothers.....Secretary

H. S. Card.....Managing Editor

W. W. Brothers.....Editor

Subscription payable in advance and postage free.

United States and possessions and Canada .....$3 a year

Foreign Countries .....$4 a year

Single copy, domestic .....25 cents

Single copy, foreign .....30 cents

Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

The Welding Engineer is a member of the Audit Bureau of Circulations and of the Associated Business Papers, Inc.

Last Advertising forms close at 8:00 a. m. on the 12th. To show proof for correction copy must be received at an earlier date and allowances should be made for delay to mails. All copy should be in by the 12th of the month at the latest.

The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

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Business Conditions

IF THEY were to be judged by general indications, the optimist would point to announcements of the erection and operation of new acetylene plants, new oxygen plants, reports from torch manufacturers of almost record-breaking business during the past month, reports of new accomplishments which widen the market, announcements of several new types of apparatus, both gas and electric, going into production, additions to plants, favorable stock market conditions, and a general feeling of "good times." The pessimist, however, will point out that on rainy days buyers are too grouchy to buy and on the sunny days they all go to the ball game.

Phone for a Welder!

NOT long ago a German manufacturer of welding apparatus built a new home, which contains an all-welded steam heating system. Screwed fittings are conspicuously absent, for over there the plumber uses a torch far more than he does a pipe wrench. Why bother carrying an assortment of elbows, when you can fabricate any kind of a pipe line from straight lengths with one tool? The question is not so far-fetched as it looks. We already have numerous welded steam lines in this country, especially in large installations. A welding school in Cleveland has given several pipe welding courses to steamfitters. A trade school in Chicago is giving welding to two hundred and fifty apprentices. How this movement could be speeded up if every person interested in the promotion of the industry would boost it in conversation with friends and neighbors. For our part, when we build our next house we're going to insist on a welded heating system. And if the darned thing leaks we'll just call up a good welder and offer him a year's subscription to fix it.

Study the Structural Steel Possibilities

IN AN age when structural steel is coming into increasing use, when research work is determining that seven figure economies can be effected by its intelligent use, when there is a hastening tendency to increase its use in small structures, the engineer and architect are thinking almost to a man in terms of riveted joints. It may take years of hard work to establish the welded joint in its proper place in construction, but to the industry it will be worth the effort. Is it going to be necessary, though, to wait for every theoretical problem to be solved to the satisfaction of skyscraper builders? Haven't we already some splendid examples of welded construction to use for precedent? Why not give a little thought and study, then, to joint design, and have some data ready for a multitude of small jobs? And then why not camp right on the trail of every man known to be planning a new building and get some real work done, save somebody some money, and make the fellow who stuck to the riveted joint jealous?

Nine Billions of Gallons

AN IDEA of the field for welded oil containers for ocean transportation alone can be obtained from estimates which show American exports and imports to have totaled nearly 9,000,000,000 gallons in 1924. Our own daily oil production is put at nearly 2,000,000 barrels by one writer. The construction of tankers is evidently an enormous industry, and it is one which carries with it almost unlimited possibilities for further application of the welding processes. It is also a field in which welding enjoys high favor. Like any other faithful old customer, it probably deserves more attention than it gets. There should be nothing complacent in our attitude toward the business which comes from such sources. It will pay, rather, to strive to increase the service which welding already contributes here.

Plants and warehouses in 87 cities make it possible for 22 District Offices always to fulfill delivery promises for

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Torch Aids Trolley Upkeep*

Gas Welding Solves Multitude of Maintenance Problems for Street Railways

MAINTENANCE of equipment is one of the most important factors in operating electric railway systems. For this reason, the oxy-acetylene process finds its greatest number of applications in the maintenance department.

Track Work

The cutting blowpipe is very useful in track work. Almost any piece of special trackage can be made by cutting pieces of standard rail to correct shape with the blowpipe and then welding them together. This is especially important to the smaller street railway system which has not the facilities to make such specials in the usual manner and yet finds it necessary to make them up.

Track Bonds Are Best Welded.

In making track joints of the conventional type, the cutting blowpipe also saves time. Rails can be cut and rusty track bolts removed in a fraction of the time required when using a saw or chisel. (When cutting a loose rail it is usually turned over and cut from the bottom.) For such jobs as cutting up old rails and laying them as guard rails, oxy-acetylene cutting is speedier, and therefore cheaper, than all other methods.

Track Bonds

Rails are bonded at the joints by copper cable for the purpose of making good electrical contacts. Welding the bond terminals to the rails insures electrical connections that will permanently retain their high conductivity. No other method has given such satisfactory results. The explanation is simple—other joints are at best contact joints, while the welded joint is a fused connection.

Car Repairs

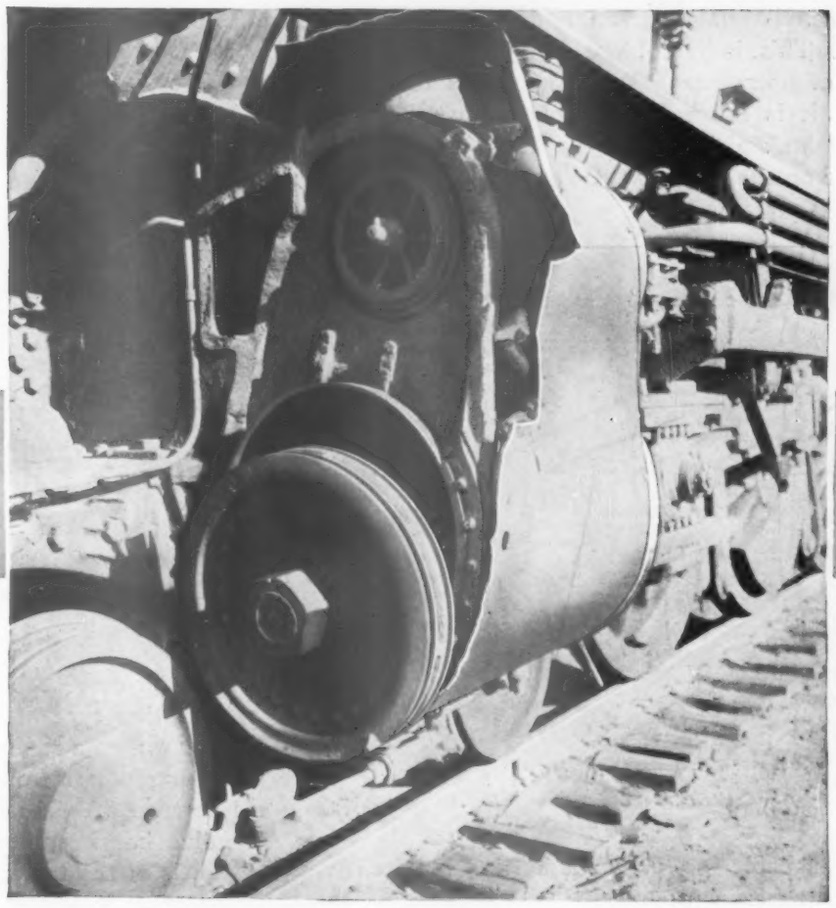
Some street railway companies find it good practice to run their cars into the shops for inspection after every thousand miles. Usually, only minor adjustments and small repair jobs that can be done without dismantling are necessary at this time. About every 18 months, however, each car is run into the shops and completely overhauled. Each part receives the most careful examination, and if broken or badly worn is repaired or replaced. With the ever increasing traffic of today, most street railway companies do not have surplus cars, so it is necessary that this periodical overhauling be finished quickly. Furthermore, the less time required to do these jobs, the lower the average maintenance cost.

Heating the Bumper for Straightening.

To expedite overhauling, it is necessary either to have a complete stock of replacement parts on hand or to discover an efficient means of reconditioning old parts. It would be out of the question to wait for the delivery of new ones and it is certainly not economical to tie up large sums of money in the bins and on the shelves of a stockroom. So the oxy-acetylene process is used to great economical advantage in what might be called "restoration work."

The following plan is used by some of the largest

Reproduced from Oxy-Acetlyene Tips, by courtesy of Linde Air Products Co.



A broken engine cylinder which was later reclaimed by welding.

417 Engine Cylinders Reclaimed Without One Failure

When you consider that a new cylinder would cost $1100, not including cost of installing, and that a fair average for welding is $260, this record becomes even more impressive.

Analysis of the cost of a typical job shows:

Cost of dismantling	$28.00
Cost of valve chamber and cylinder rings	35.00
Cost of chipping, studding and setting rings in place ready for welding	25.00
Labor cost for welding	108.00
Labor cost for machining	8.00
Cost of electric power	22.00
Cost of Electrode material	30.00
TOTAL	$256.00

The repair of broken cylinders is only one of the many jobs which arc welding performs in railroad shops. The G-E Arc Welder is a money-saving tool of vast importance to you.

The G-E Arc Welder gives 24-hour service day after day. It can be readily adapted to light or heavy duty work. It is simple, and easy to operate.

There should be no doubt of the value of a tool that does these things. The welding specialist in the nearest G-E office will gladly answer all your questions.

28-8

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN ALL LARGE CITIES

systems. A relatively small stock of parts is kept on hand. This is just large enough for a continuous cycle of operations. When a part is removed from a car, it is immediately replaced by one from the stockroom, and is then repaired and returned to stock for use on the next job. Of course, parts that are not

Cutting Rivets to Dismantle Trucks.

interchangeable or unavailable are repaired while overhauling is in progress.

Two jobs which make use of the oxy-acetylene process are the repair of side sills and bumpers. When a sill is bent, it would cost a great deal of time and money to remove the whole plate (possibly destroying the bolt threads in doing so), then to carry the sill to a forge, heat and straighten it, put it back and repaint it. It is much easier to wheel a portable welding outfit to the car, heat the bent sill while in place, and force it back to shape with clamps or a sledge. The same applies to a bent or cracked bumper, for a great many of these can also be repaired in place. Of course, if the bumper is broken in two, it must be removed from the car for repairing, but even then, welding can save it from the scrap pile.

When a car comes in for its periodical overhauling, the body is disconnected from the trucks, jacked up, and the trucks removed. Then the body is stripped of all its fittings and both body and fittings are completely overhauled. A great many metal fittings, such as seat frames and supports, then find their way to the welding department for repair.

The trucks are moved to short tracks over pits. The first operation in taking them apart consists in cutting all bolts and rivets with the blow-pipe. Cutting bolts might seem unnecessary, but in reality it is a great time saver, as most of the nuts are rusted tight.

If the nuts were unscrewed the threads on either nut or bolt would be stripped. So the bolts as well as the rivets are cut. As the men remove each part from the truck it is carefully inspected for breakage or wear. If defective in any way, the part is immediately sent to the welding department for a quick and economical repair.

Repairs to Braking System

Probably no parts under the car are subject to more wear than the braking mechanism. Power to brake the wheels is transmitted from the piston in the air cylinder through a series of levers to the brake shoes. In one system, for instance, it travels from the plunger to the body brake lever, thence to the pull rod, truck brake lever, brake beam, brake shoe heads and brake shoes. All these must not only be connected, but they must also be supported with pins or bolts. Since everything must have a running fit in the holes it is easy to see that constant use wears the pins and elongates the holes. Various levers, rods, beams, and hangers are frequently worn at certain spots from continually rubbing against some other parts of the undercar structure.

Old pins are discarded and new ones used in reassembly, but money and time are saved by filling in all elongated holes by welding and then redrilling them for correct diameter.

Another type of braking mechanism employs what is known as a radius or circle bar. This transmits the braking power from the pull rod to the truck brake levers. As the brake shoes and pin holes wear, the radius bar is pulled over toward the pony or idler wheels of the truck, often so far that the flanges rub and wear it almost through. Here then, is another building-up job for the welders. Many of these radius

Compressor Shells Receive Attention.

bars are salvaged together with the other levers, rods, beams and hangers.

Air compressor shells also receive the attention of the welding department. Sometimes the side of the shell itself is broken, but more often just a bearing lug has been snapped off. If there is a hole in the shell, a piece of plate is cut to fit, the edges of both chamfered, and the plate welded in. Then the weld is tested with kerosene to make sure it is absolutely tight. Or if a broken bearing lug has brought the

Photo courtesy
Bastian-Blessing Co.

The Weld is no Stronger than the Filler Rod

Whether the weld will hold after it is machined and the excess reinforcing material removed, depends on the welder's skill and the kind of filler rod used.

Tobin Bronze Welding Rods have a homogeneous structure, flow freely at welding temperature and make strong joints that are easily machined. A Tobin Bronze Weld is 100% stronger than cast iron and equal to or better than the best steel weld.

An exclusive Anaconda product, with the name stamped in the metal, Tobin Bronze is universally recognized as the most satisfactory non-ferrous filler rod for repairing broken cylinders, gears and all kinds of machine castings.

If you cannot obtain Anaconda Welding Rods from your regular source of supply, let us tell you who handles them in your locality.

ANACONDA
from mine to consumer

Anaconda Welding Rods and Wire are made of Tobin Bronze, Phosphor Bronze, Manganese Bronze, Silicon Copper, Brass and Muntz Metal.

Supplied in the standard 3' lengths, special lengths and coils, in 1/8", 3/16", 1/4", 5/16" and 3/8" diameters.

ANACONDA AMERICAN BRASS LIMITED
NEW TORONTO, ONTARIO
Manufacturers of Copper, Brass, Bronze and Nickel Silver in Sheets, Wire, Rods and Tubes

TOBIN BRONZE

Trade Mark Registered in Canada

shell to the welding shop, the piece is welded back on again. When the lug has been lost, a new piece is worked up from steel by the blacksmith and then welded in place.

Other Truck Repairs

While repairs are being made on the braking system, the dismantling of the trucks continues. The motor suspension system makes use of steel bars and

Putting the Feet Back on a Controller Box.

yokes, and, as in the case of the brake mechanism, holes become elongated and are filled in for redrilling.

Vibrations of a car often throw a gear case out of line and the gear chews a hole in it. These malleable iron castings are then sent to the welding shop. A steel plate large enough to cover the hole is cut and welded over it. This is the simplest and probably the most satisfactory method of making this repair.

Rivet holes in the side and end frames of the truck become worn after the rivets have been loosened by vibration. The same thing happens to the holes in gusset plates. All receive similar treatment. They are filled in by welding and then redrilled.

Truck side frames sometimes break at the pedestal. It is common practice to repair them by carefully chamfering and welding the break. Then a piece of bar is forged to fit over the top of the pedestal. When it is approximately in place, it is heated with the welding blowpipe and clinched down tight on both sides. In forging the bar, the edges of the face that fits against the side frame are beveled, so that when the bar is in place there is a groove along its joint welded. The frame, because of the reinforcement, is then stronger than it was originally.

When it is necessary to scrap a car wheel the axle is often worth salvaging. Sometimes, however, the wheel is shrunk on so tight that it cannot be removed in the wheel press. Such wheels are cut off with the blowpipe. Starting at the flange the cut is worked inward toward the axle until it is possible to crack the wheel with a sledge blow.

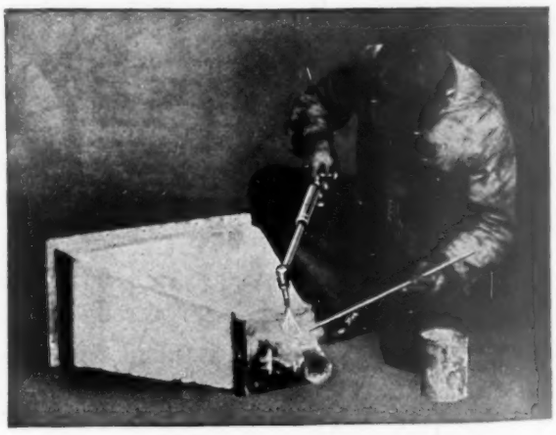
Repairs to Electrical System

Carbon brushes are kept in contact with motor commutators by a spring. Brushes are set in brass holders which pivot on pins and have springs attached on the opposite ends. The holes in these brass castings become elongated, and if new brushes were installed without repairing the holder they would not bear on the commutator correctly. So the holes are filled up with metal from brass welding rod and then redrilled.

The same condition is met in trolley stands—the casting which holds the trolley pole. A strong spring applies the force through the fulcrum of this stand to keep the trolley against the wire. Due to the sag in the wire between supports, the pole oscillates continually, causing wear on the fulcrum of the trolley stand. This makes it necessary to fill in and redrill the holes through which the fulcrum pin passes.

While on the subject of the current collecting system, mention should be made of the controller box. The cast iron lugs by which it is bolted to the floor of the platform are often broken off and must be replaced by the welders.

There are literally hundreds of other repair applications of welding made on electric railway sys-



Sand Boxes Are Restored.

tems. Each different type of truck or car offers some new possibility of saving time and money through use of the oxy-acetylene process. It is even employed economically to repair the bronze signal bells used on some trolley cars!

Special Subway Equipment

The uses of the process in subway, elevated, and interurban railway maintenance are likewise numerous. Many applications are similar to those already mentioned, but of course there are some other ones due to the different construction of cars and trucks.

Cars operated in long trains have hundreds of parts not required by the single surface car, such as draft gear, third-rail shoes, door-operating devices, and other auxiliaries. A frequent repair is made on ratchet castings used to adjust shoes for collecting current from the third rail.

There is a bolt fastened to each which holds it in place. On one type this bolt is attached by means

Touching Up the Frame.

of a shackle, a part of the casting itself. The pin through this wears the holes which are then filled in and redrilled. Another type of ratchet casting has the bolt welded directly to it. When this bolt wears out it is a simple matter to cut it off with the blowpipe and then weld on a new one.

Even the storage batteries used to furnish current for emergency lights in subway cars are repaired with blowpipes. Old plates are taken out and new ones attached to the connectors by the familiar process of lead burning. A series of inverted U-shaped strips attached to a base serves to form the jig used to hold plates in position during the operation of welding.

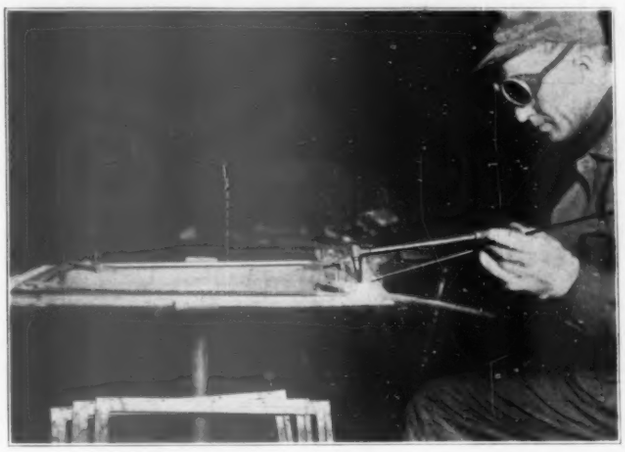
In fact jigs are used wherever possible to speed up operations and aid in securing welds of excellent quality. Fig. 11 illustrates one of these. The operator is building up small door latches. This jig was easily made by welding two short pieces in 1-in. by 1-in. angle iron, heel to heel—a simple device which saves time and holds the piece in correct position for welding.

Another Type of Jig

Another time-saving fixture, made up by the welders, is nothing more than a table with a revolving top. Work is clamped to this, as shown in Fig. 14. In the illustration the operator is shown welding the corners of a display card holder used on the front of surface cars. The four sides are cut with mitered ends from the stamped strips, then clamped in place on the table and welded. The corner clamps, which are held to the jib by wing nuts, have their outer ends veed so that one prong of the vee rests on each side of the corner. The weld can be made between them. This is one "production" job which is frequently encountered in street railway shops. There are, however, a few others.

One street railway company, operating several hundred cars, saw the need for special brackets to reduce motor vibration. They readily made these by oxwelding a 1-in. bolt about 1 in. long to each end of 2-in. channels 2 ft. long.

Some shops, however, occasionally do some fabrication closely allied to production. As a general rule, the engineering departments of good sized systems



A Convenient Jig.

are continually experimenting—changing designs and trying out new ones. For fabricating miscellaneous new equipment or changing over old equipment to conform to new designs, the blowpipe is very useful. All is done in the interest of reducing the cost of maintenance—a primary consideration.

An instance of modernizing or improving equipment is illustrated by the work done on some brackets which form a part of the door interlocking mechanism of subway cars. These might be termed "offset-yoke brackets," since they are castings with two curved arms perpendicular to a base plate.

The castings are small, being only about 4 in. in their greatest dimension. Holes in both arms line up so that a small rod can work through them. Part of the rod between the arms is surrounded by a spring, one end of which is held by a pin through the rod. As first constructed, the other end of the spring merely rested against the inside face of one arm, and as there was nothing to hold it in a fixed position, it frequently interfered with smooth action of the rod.

Forming a boss to hold the spring in place solved the difficulty. This was readily done by filling in the

pinhole and building up the boss by welding. Then the hole was redrilled and the boss machined down so the spring slipped over it. It only required a few minutes to revise each casting, but the results went a long way toward securing perfect operation.

Another alteration job consisted in cutting away a part of each axle cap so a new oiling system could be used. In fact, when a part fails to function properly,

From Junk to Usable Parts.

or it is considered desirable to modernize any particular piece of equipment, the welding and cutting blowpipes are very useful tools.

Conclusion

The specific applications mentioned above are merely representative. They were picked at random and do not by any means cover the whole field.

The scope of oxy-acetylene applications includes also the repair of shop machinery and the fabrication of special equipment. In fact, anything of metal about the right-of-way, the car, the shop, or the power plant, when broken or worn, can be repaired with the aid of oxy-acetylene welding and cutting. The value of the process in the power plant and shop need not be dwelt upon at length. This has been done elsewhere. Typical applications include mending large and small castings, restoring worn or broken forgings, fabricating steam lines, and even constructing small metal frame buildings. Thus the importance of the oxy-acetylene process as a whole can well be judged. It is a means of maintaining the entire electric railway system from track to trolley and from power plant to shop. Best of all, it saves dividend money in thus accomplishing it.

NEW BRAZING COMPOUND FOR CAST IRON

The Metal and Thermit Corporation, 120 Broadway, New York City, have just placed on the market a new brazing compound for use on cast iron work. Its use in the brazing operation prevents the oxidation of the iron at and around the joints while the heat is being applied. The manufacturers of this compound claim that its use does away with chamfering or otherwise preparing the joint or parts to be brazed and that it gives a close union between the brass and cast iron. The joint is also said to be machinable.

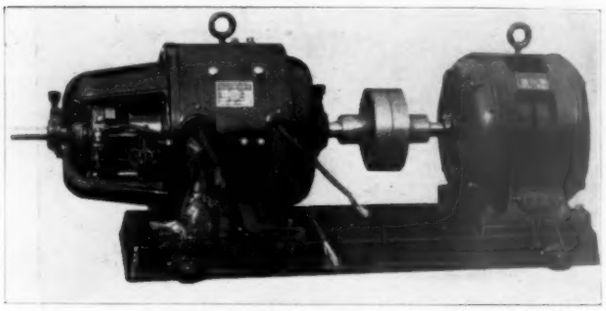
SIGHT FEED PORTABLE ACETYLENE GENERATOR

The Sight Feed Acetylene Generator Company, West Alexandria, Ohio, have just announced a new sight feed portable acetylene generator. This is described in detail in a bulletin which has recently been placed in the mail. It is claimed that this generator produces acetylene of very high purity. Granulated carbide is used. It is held in a Pyrex glass cylinder or hopper mounted in cast aluminum tops and bottoms and protected with a circle of stiff steel rods. This generator is portable and manufactured in four sizes to meet varying conditions.

NEW WELDING GENERATOR

The Electric Arc Cutting and Welding Co. of Newark, N. J., have developed a new welding generator which has the following features not heretofore incorporated in any welding or cutting apparatus:

The Generator gives D.C. and A.C. so that uses for welding that are best adapted to either are included. For instance, some prefer the alternating current for spot or tank welding, semi-arc, and nickel-flash processes on thin cast iron, general cast iron and malleable iron work, and provision is therefore



A. C. and D. C. Generator.

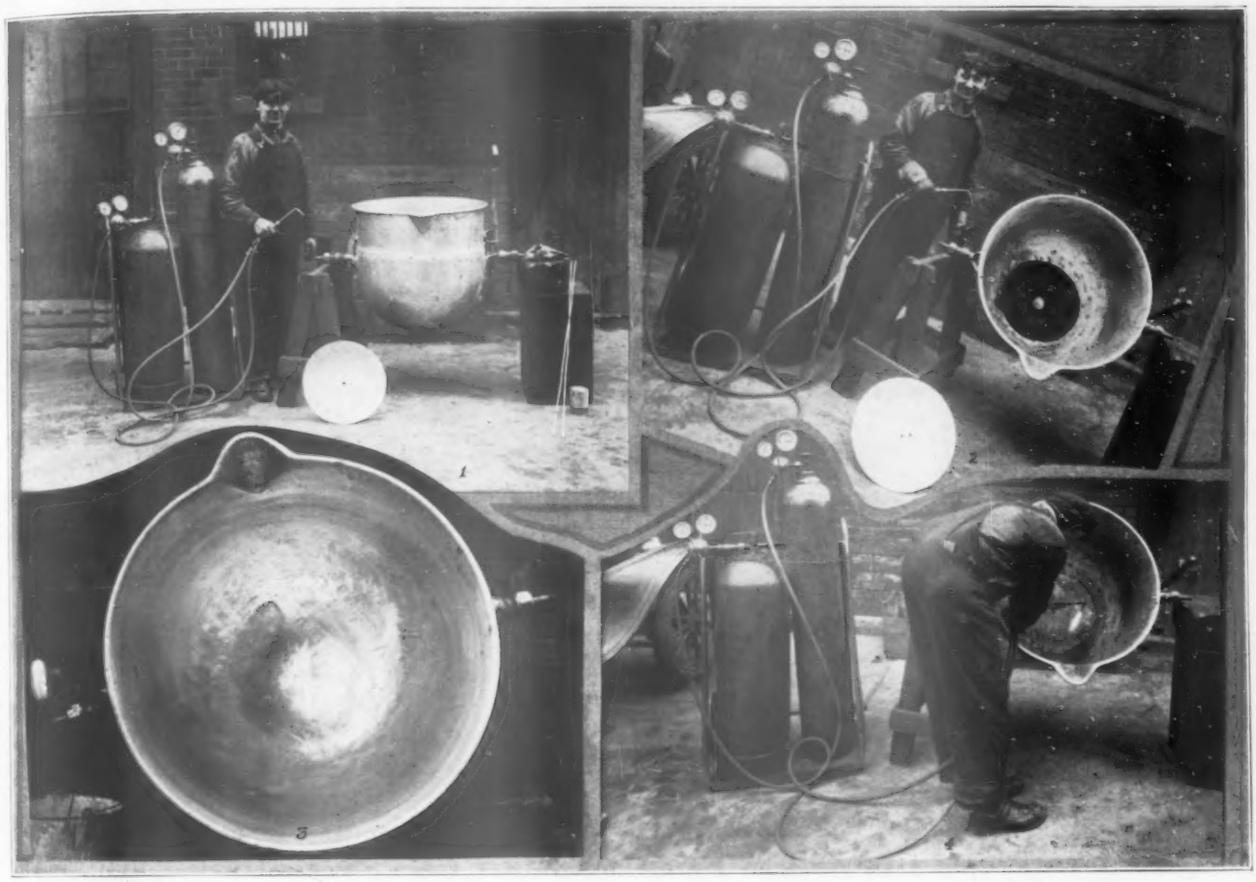
provided for such alternating current welding. Those who like D.C. may have full capacity in this current also. The same winding of the armature serves for both so that no extra space is required. The only extra is two collector rings for the alternating current supply.

The main feature about the Generator is that either the A.C. or D.C. leads can be short circuited right at the collector rings or commutator without injury; the generator voltage simply dies to a value that holds the current constant, and no injury is done to the generator while in this condition. Immediately the short circuit is released normal voltage resumes. The Generator is ball-bearing, has a power take-off at both ends for drive, for air compressor, or anything else to be driven. The Generator can be driven direct, or by belt, or chain, from an electric motor, gas engine, steam engine or any source of 7 H.P.

THE EIGHTEENTH ANNIVERSARY OF THE ALEXANDER MILBURN CO.

The Alexander Milburn Company, believed to be the oldest exclusive manufacturer of Welding and Cutting Apparatus and Portable Carbide Lights, is commemorating its 18th anniversary. Since May, 1907, the Alexander Milburn Company has developed and manufactured Portable Acetylene Lights, Acetylene Generators, Cutting and Welding Torches, Pre-heating Burners, Gas Regulators and allied devices, which it markets throughout the United States, Canada and through the export trade.

Alexander F. Jenkins, its president and founder, is the inventor of most of its apparatus, including its Combination Cutting and Welding Torch, which by the interchange of tips either cuts or welds. The company has a well established experimental and manufacturing plant of which it is justly proud. It also has numerous sales engineers, distributors and service headquarters to take care of its customers.



1. Illustrates Depth of Kettle. 2. Where the Patch Was Inserted. 3. The Finished Job. 4. Putting in the Patch.

WELDING SAVES ALUMINUM JACKETED KETTLES

Large Steam Jacketed Aluminum Kettles Used in Restaurants and Candy Factories Are Not Lost When Water Gets Too Low—Welding Properly Done Returns Them To Service In Short Order

GENIAL Joe Smith first ran upon the problem of welding aluminum steam jacketed kettles about two years ago when a candy company sent in a hurry call for first aid to the welding shop in which he was employed. Joe was called upon to tackle the work and did it in such a thorough manner that whenever any of this type of work had to be done he gets the call. To see his grin you wouldn't be very impressed with the difficulties which such a job presents, but this is not surprising for when you ask him about it he hasn't much to say. To quote Joe, "All I did was to clean her out, shape her up, cut out the hole, cut out the patch, tack her in and then keep on welding from the last tack until I got all the way around to the start." Seems simple doesn't it.

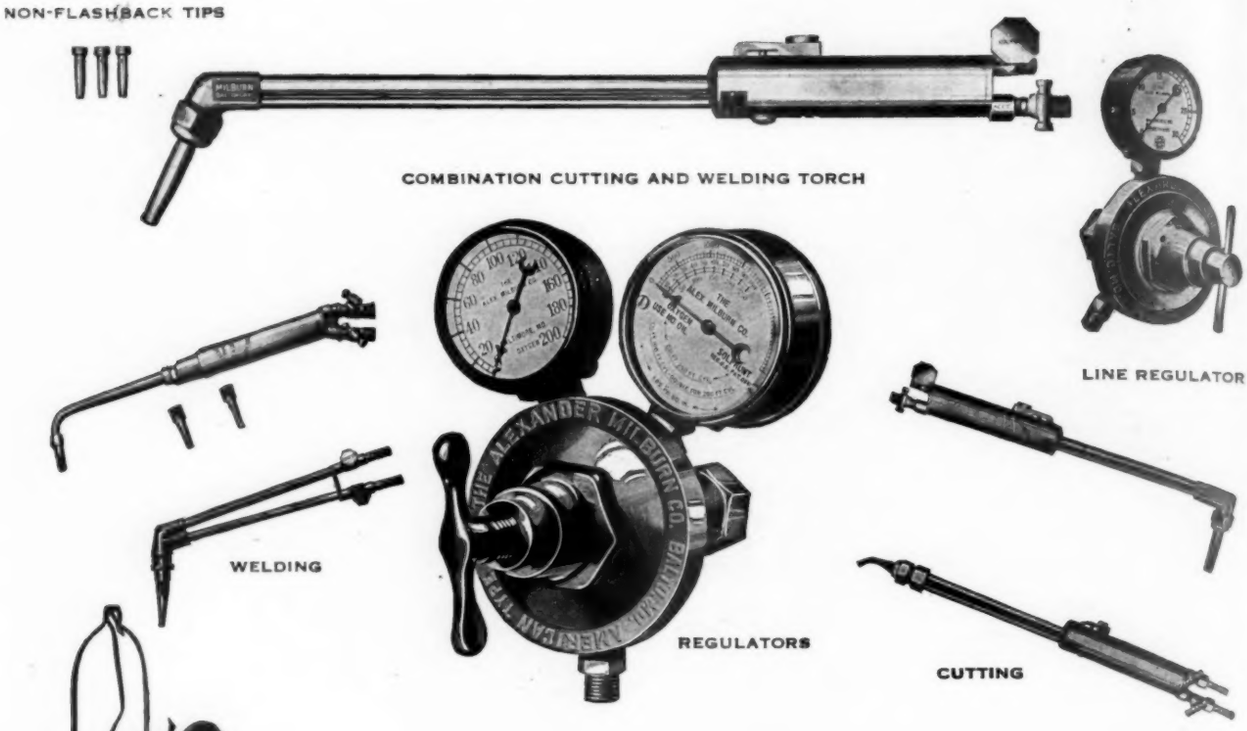
The first piece of work of this kind was a much harder one than this last one according to Joe. It was about three and one-half feet deep and it could not be turned on its side or in any other position. He had to drape himself over the edge and work with his face right down inside the kettle with the fumes of the flux and the heat making it almost unbearable. Here the old bandana came to the rescue for he pulled it down over his nose and mouth in the form of a mask, keeping out the fumes to a certain extent. Since then he has welded three kettles similar to the one shown here and the first one has been in service about a year without showing any signs of failure, the second one has been on the job about six months and the last one is just starting its new career in a John R. Thompson restaurant.

Joe Smith works in the shop of F. J. Dennis, Chicago, where a great many exceptional welding jobs have been performed. He is an old timer at the game and experienced in all processes although he likes the oxy-acetylene best. It was with this process that he did the work on the kettles.

Something of the size of the kettle can be seen by comparing it with the size of the welder. The inner and outer shell are separated by about one-half inch space at the sides and this increases in width as the bottom is nearer, so that at the bottom the distance between the two is about two inches. In the exact center of the kettle there is a post used as an anchor for the upper or inner shell. The shell broke out in such a manner that the center post came in the center of the patch and you will observe that there is a small hole there. This was left so that it would be easy to locate the post and weld the patch to it.

It was first necessary to shape the fracture and bulge caused by the blow-out back to normal shape. Heat was applied and a hammer used. Joe's previous experience had shown him that where the bulge was very bad it is not wise to use the hammer as the metal will not stand the steam pressure when it is put back in use. This was not learned by failures, however, but merely by trying to bend a badly bent piece of aluminum back to shape and then observing the surface on the under side. It will always be found to contain numerous small fractures which would later lead to trouble. This being the case it was necessary to cut out a large hole to overcome any possibility of failure. The hole was cut twenty-two inches in diameter.

The largest sheet aluminum they could buy was only twelve inches wide and forty-eight inches long by one-quarter inch thick. It was found necessary to weld two of these sheets together so that they could cut out a patch the proper size. Here there is a point worth remembering and that is that the patch should be just the size of the hole and no room allowed



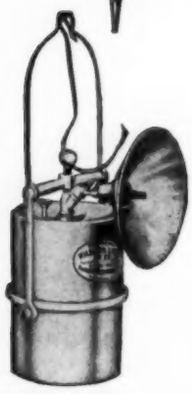
EIGHTEENTH ANNIVERSARY OF

THE ALEXANDER MILBURN COMPANY.

This business since May 7, 1907 has been exclusively devoted to the manufacture of the apparatus for which this Company is world famous.

This Company has been largely instrumental in the scientific development of welding and cutting apparatus, carbide lights, acetylene generators and gas regulating devices.

This Company is believed to be the oldest exclusively devoted to this art.



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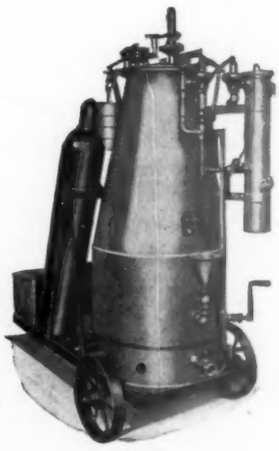

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REGULATOR ASSEMBLY

TIP MANUFACTURING

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SHOW ROOM

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PORTABLE LIGHT MANUFACTURING

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THE ALEXANDER MILBURN COMPANY

BALTIMORE, MD.

for the welding material. If a space is left the job will be ragged, for a large rod must be used and the metal will also form a ragged bead on the under side of the pieces to be welded.

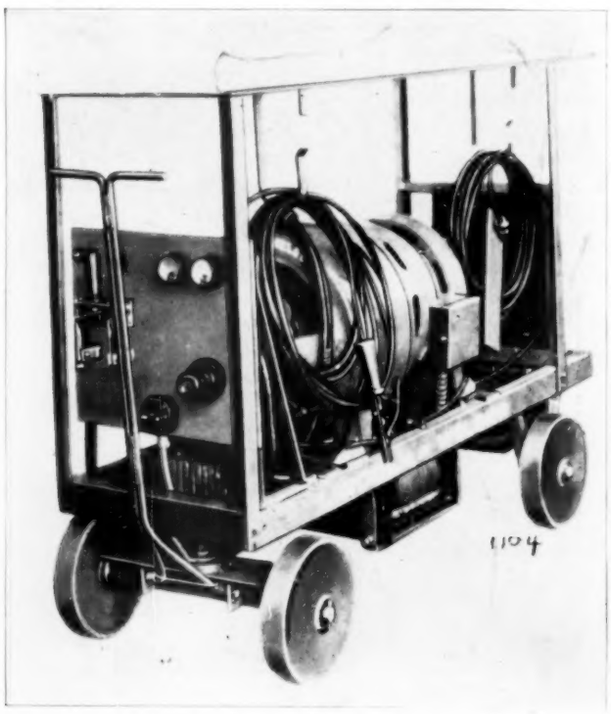
Before welding the patch in place it was necessary to heat it and shape it with a hammer to conform with the inside of the inner shell. After this was done the patch was tack welded in position and then welded to the center post. Tack welds were put in about every four or five inches and when the last tack was set the welding started, continuing right around to the first tack, then to the second, third and so on. A pure aluminum filler rod was used and Joe has found that on this type of work fair results may be obtained with a quarter inch rod but the best and most finished results follow the use of an eighth-inch rod. This gives a much smoother weld. Flux was freely used throughout the welding.

After the job was completed it was tested out under thirty-five pounds hydraulic pressure. This was deemed ample as the kettles are used under a thirty pound steam pressure. No leaks of any kind were found. In some of the other kettles pin hole leaks were discovered, but when they were closed up the job was pronounced first rate, and the length of service which they have given proves that this proceedure is reliable.

Acknowledgment is made to The Bastian-Blessing Company, Chicago, for the use of the photographs which illustrate so well the kind of a welding job which doesn't defeat a good welder.

LINCOLN RAILROAD WELDER

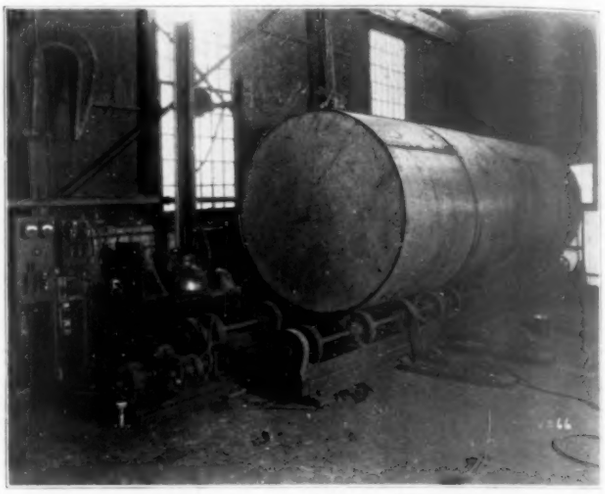
The Lincoln Electric Company, Cleveland, Ohio, have just announced a new piece of welding equipment. This new welder is specifically adapted to railroad shop use and was designed especially for this type of work. The welder is a typical stable arc Lincoln equipment, 300 amperes in size. It is equipped with roller bearing wheels so that it is portable and



New Lincoln Railroad Welder.

easily moved about the shop, in addition it is very narrow being only 21 inches wide. This allows it to travel through narrow places. The frame extends beyond the welding equipment and in this way prevents injury to the outfit from backing it into objects on the floor. The weight of the machine is swung low so that it will not tip over.

The Lincoln company has also perfected and just put on the market an automatic welder, for use in the manufacture of storage tanks. The possible saving estimated through use of the new welder in the construction of storage tanks, is said to be based upon the actual findings proven in the case of an installation of the equipment in a tank manufacturing plant. With the new automatic equipment it is stated that two hours and thirty-five minutes are saved on each 550 gal-



New Lincoln Automatic Tank Welder.

lon tank built. The new automatic welder will completely weld a large tank in one hour and twenty-five minutes, against the old average of four hours per tank. Tanks of single or multiple sections can be welded by following the same method. The illustration shows the installation of an automatic welder for seams and girths of an underground storage tank. The entire tank is assembled and tacked together. Longitudinal seam welds are made by an automatic moving head attached to a single copper guide. After seam welds are made the tank is laid on wheels and revolved under an automatic carbon head, making the girth weld. The average welding speed is between 50 and 60 feet per hour.

TULSA'S NEW ACETYLENE PLANT

Oxygen manufacturers who are interested in compressed acetylene plants, will be interested in these two views of the acetylene plant of the Tulsa Oxygen Company, at Tulsa, Oklahoma.

This plant has been in operation since the first of the year and has given no trouble whatsoever in operating. The buildings are

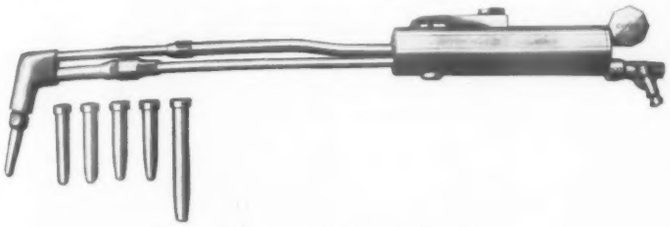
Tulsa's New Oxygen and Acetylene Cylinder Charging Rack.

of concrete and brick construction and the compressing room is concrete and steel with an asbestos roof.

In one of the pictures will be noticed the company's oxygen plant which is about a block away from the acetylene plant. This makes it very easy for customers to get their requirements of oxygen and compressed acetylene.

THE NEW MILBURN LOW PRESSURE TORCH

The Alexander Milburn Company, of Baltimore, Md., have recently placed on the market a low pressure torch which they claim will operate on either low pressure or high pressure gas with equal efficiency. It is especially constructed to operate with low pressure acetylene gas, city gas or hydrogen, is said to be excellent for use with a low pressure Acetylene generator.



New Milburn Low-Pressure Torch.

The makers further state that this torch is very efficient and utilizes the highly specialized and standardized parts of the Milburn cutting and welding torches insuring a correct and intimate mixture of the oxygen and acetylene, resulting in non-flashback qualities. This torch is adapted to perform welding as well as cutting work by the interchange of tips. It is designed to perform practically all the cutting and welding operations within range of the process with high efficiency and economy. The torch is of bronze forgings and special seamless tubing, constructed for constant service. The tips are made of solid copper.

SPECIAL TRAILER FOR GAS WELDING OUTFIT

In order to provide for the quick pick up of oxy-acetylene welding outfits for transportation to special jobs, The Linde Air Products Company has recently suggested the construction of a trailer to run behind a motor truck or to be pulled by hand for a short distance. The suggestion for the body of the trailer is that it just be large enough to hold a tank of oxygen and a tank of acetylene, regulators, hose, torches, tips, wrench, welding rods and goggles, with a cover hinged half way down the sides and opening out from the center and built so that the apparatus will be protected from weather when the cover is closed. It is further suggested that it be so balanced that it can easily be tipped up and leave the apparatus in a convenient position so that welding can be carried on without moving the cylinders from the containers.

WELDING USEFULNESS INTO OLD TROLLEY WHEELS

The welding torch has extended its usefulness to the point of finding additional service for the humble trolley wheel to perform, at least in cities where heavy sleet and snow storms leave trolley wires coated thickly with ice. Little blades of bronze are welded across the grooves of worn-out wheels and the result is an efficient ice cutting device at an exceedingly low cost.

AN UNDER WATER CUTTING JOB

In the April issue of Current News, which is published by the Electric Controller & Mfg. Company, of Cleveland, there is an interesting account of an under water cutting operation recently completed with success in New York harbor. A schooner had been wrecked during a snow storm and the bottom opened up by the ship's false keel being torn off. It was desired to salvage the cargo of timber on board but before pumping out the water it would be necessary to seal the bottom with canvas. Divers who went under the ship to prepare for the work found that when the false keel had been torn loose the holding bolts had been left sticking out in all directions. So many of these bolts projected out along the keel that it was impossible to stretch canvas without first removing them.

The Merritt, Chapman & Scott Corp., of New York City, then brought into service their electro gas burning torch for under water cutting. It employs a flat carbon electrode with two holes through its center to feed oxygen into the arc. With these torches divers were able to cut off the steel bolts flush with the steel timbers and thus clear the way for the canvas. Even under adverse working conditions the divers were able to cut off bolts in as short a time as two minutes. Cutting under these circumstances is not very favorable because harbor water is usually so dirty that a diver cannot see his work and the motion of the tides and continual movement of the water make it very difficult to hold an arc between the electrode and the metal on which he is working.

GETS NEWSPAPER PUBLICITY FOR WELDING

An interesting and really instructive story of the progress which is being made in extending the use of the welding process has a somewhat difficult time in competing for attention in the newspapers with the base ball news and the latest murders but occasionally a correspondent has an opportunity to inform the public what great strides are being made in our industry.

For example, Mr. R. K. Randall, Supt. of Welding Courses at the Y. M. C. A. School, Cleveland, Ohio, has made several contributions to the Cleveland Times on these subjects. In the issue of April 9th there was published over his name a story entitled "Brazing Fills New Place in Present Day Industry." This article describes the development of the process of joining cast iron gas pipe lines by brazing.

WIRE MEN PROTEST WELDING WIRE CLASSIFICATION

About a week before the hearing of the Consolidated Classification Committee, which was held in the new Union Station Building, Chicago, on April 21st, C. T. Allen, Secy. of the Gas Products Association called a meeting of association members and representatives of welding wire manufacturers and distributors in Chicago to formulate a protest against the creation of a separate classification for iron and steel welding rods. Mr. F. B. Toombs of the Chicago Steel & Wire Company, at whose suggestion the meeting was called, was appointed Chairman of the meeting and discussion of the best procedure to follow in putting this protest on record occupied a busy hour. The matter was finally left to a committee consisting of Mr. Toombs, Mr. C. Kuhn of Jos. T. Ryerson & Son, Mr. J. F. Bolger of the Central Steel & Wire Company and Mr. K. R. Hare of the C. H. Hollup Corporation.

Protest against the classification mentioned was based upon the arguments that there is no essential difference between iron or mild steel wire for welding and iron wire of many other descriptions except that care must be exercised to see that it is uniform; that from the standpoint of value there is no justification for a higher rate; that iron or steel for welding is no more susceptible to damage in transit than any other kind of wire; that a very distinct discrimination has been made against manufacturers of mild steel and iron welding wire who sell their products for this specific purpose in favor of other manufacturers who sell their product on an analysis basis only and do not describe it as welding wire

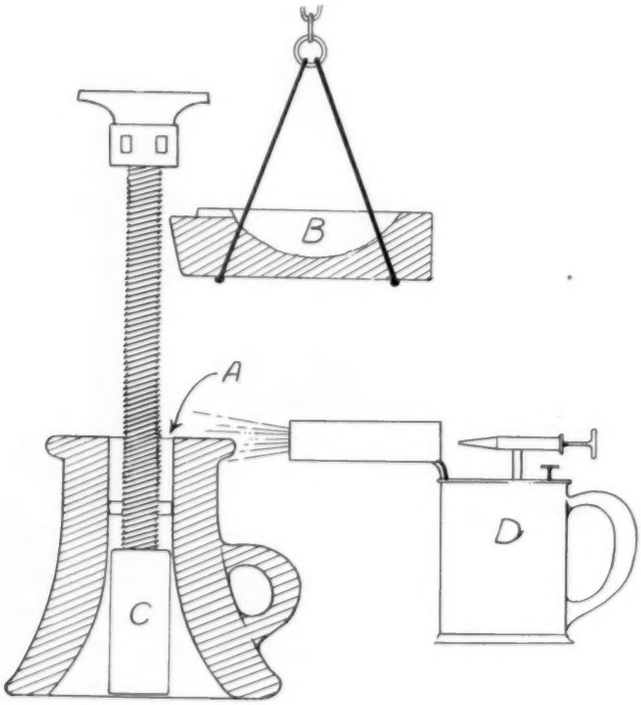
The attendance at the meeting included: Mr. K. R. Hare, C. H. Hollup Corp.; Mr. A. Kahn and Mr. J. F. Bolger, The Central Steel and Wire Company; Mr. F. B. Toombs, The Chicago Steel and Wire Company; Mr. L. C. Hoff, The Page Steel & Wire Company; Mr. C. B. Nicholson and Mr. J. W. Baumgartner, John A. Roebling s Sons Company; Mr. C. Kuhn, Jos. T. Ryerson & Son; Mr. A. Lewis and Mr. B. J. Smith, Union Carbide and Carbon Corporation; Mr. H. B. Pearson, Burdett Manufacturing Company; Mr. J. M. Cameron, Torchweld Equipment Company; Mr. M. L. Goodrich, Swift and Company; Mr. W. S. Noyes, Imperial Brass Manufacturing Company; Mr. E. A. Faulhaber, Burdett Oxygen Company; Mr. E. D. Findlay, Acme Oxygen Company; Mr. H. S. Card, The Welding Engineer; Mr. C. T. Allen, Gas Products Association; Mr. A. H. Zillner, Oxweld Acetylene Company; Mr. Stuart Plumley, Acetylene Journal.

CASTING BRONZE WITH OXY-ACETYLENE

By C. Haeusser

A contractor brought a ten-ton screw jack into our shop. The steel screw was in good shape, but the cast iron female thread was stripped. When he asked me if it would be ready in the morning, I said, "Yes." I noticed that the mischievious twinkle in his eyes, changed to a look of surprise. He must have thought I was going to be stuck.

First the old thread was roughly chiseled out to the depth of ½ inch, as shown at A, leaving a few of the old threads at the bottom. After painting the screw with a whitewash made of



plaster of Paris, giving it also a coat of smoke with the acetylene flame, the jack was heated with the blow torch, D, before pouring in the molten bronze. A fire brick, B, having been hollowed out previously with a cold chisel was heated in a forge or stove and suspended at C in the proper position for tilting to pour the bronze into the jack body. To melt the bronze, we placed the bronze in the brick with a little salt and borax. A good sized tip of an oxy-acetylene torch was used for melting the Tobin bronze. After casting the thread and allowing the job to cool off the screw is taken out and oiled. The bronze thread will be as sharp and perfect as if cut in a lathe.

News of the Welding Trade

The American Oxygen Service Company of New York City has acquired a ten-acre plant site near Jersey City, upon which it will erect plants for the manufacture and distribution of a complete line of industrial gases, including acetylene. The main office of the company was recently moved to the Pennsylvania Building, West 34th St., New York City.

William Wharton, Jr. and Co., Inc., announces a change in address from 30 Church street, to 50 Church street, New York City. The new location is on the 19th floor.

The Burdett Oxygen Co., Alton Park, Chattanooga, Tenn., is contemplating the erection of a new plant for the production of commercial oxygen, estimated to cost $100,000 including machinery.

Specifications for steel and iron pipe for oil country uses have been published in pamphlet form by the American Petroleum Institute, 15 West Forty-fourth street, New York. In view of the fact that some of the makers of pipe are said to be looking with favor toward accepting the specifications, the availability of the pamphlet is of current importance.

A recent issue of the Iron Trade Review features a brief biography of Charles L. Bastian, of The Bastian-Blessing Co., Chicago. It is a splendid tribute to the great energy and mechanical achievements of one of the most highly regarded men in the welding industry.

It is reported that a one-story welding and machine shop is soon to be constructed in Louisville, Ky., by the Service Welding Company, of that city.

Announcement has been received from the Alexander Milburn Company, Baltimore, Md., manufacturers of oxy-acetylene welding and cutting apparatus, of a monthly prize photo contest, offering a prize of $25.00 for the best photograph or sketch illustrating work done with Milburn welding and cutting apparatus. The photographs or sketches must be accompanied by cards supplied upon request by the home office of the Milburn company. Decision will be made and check mailed to the prize winner, it is announced, on the 20th of the month following the receipt of the picture.

Mr. K. B. Bleecker has been transferred to the Chicago office of the Page Steel & Wire Company and will represent the Welding Wire Department in the Chicago territory. Mr. W. E. Burner has been transferred from the Welding Wire Department to another department, but continues as a representative of the Page Steel & Wire Company in Chicago.

It is reported that the Warner Brass Works of Chicago has taken over the gas welding apparatus business of the Federal Brass Works of Chicago, Illinois.

W. A. Slack, president of the Torchweld Equipment Company, has recently returned to Chicago after an absence of several weeks on a series of extended business trips. Mr. Slack is receiving congratulations on the fact that since the price of his new Hudson sedan dropped $100.00 during his absence he succeeded in collecting a good sized check for his rebate.

New district sales offices have been opened by Linde Air Products Company at Minneapolis, Birmingham and Tulsa. C. E. Donegan is Sales Manager at the Minneapolis office at 716 First National Soo Line Bldg. Mr. W. A. K. Kopp is in charge of the Birmingham office at 409 Lincoln Life Bldg., and Mr. G. B. Grubb at Tulsa in Room 508 Exchange National Bank Bldg.

A one story addition is being constructed for the shop of the Minnehaha Welding & Machine Company, 3750 Minnehaha Avenue, Minneapolis, Minn.

The Owosso Boiler & Welding Works at Owosso, Mich., have begun work on the construction of a large one story addition.

Harry L. Barnitz, Ph. G., Consulting and Construction Engineer, specializing on oxygen, hydrogen and industrial gases, exploiting Messerschmitt Hydrogen Process, announces the removal of his office to 2 Rector Street, New York City, on May 1st.

The Chicago office of the Alexander Milburn Company recently moved from 218 South Wabash Avenue to 220 South State Street, Mr. Fred Squire in charge.

Announcement has been received of the appointment of J. W. Foster as District Sales Manager for the Linde Company at Baltimore. Prior to this appointment Mr. Foster was a senior salesman of the Linde Company in the Pittsburgh district.

R. E. Kinkead, the former Chief Engineer of the Welder Division of the Lincoln Electric Company, Cleveland, Ohio, has been transferred to the Sales Department. He is now Regional Director of Sales with headquarters in the Ellicott Square Bldg., Buffalo, N. Y.

The Compressed Gas Manufacturers' Association promises an especially interesting program for their May luncheon and meeting, which is scheduled for Thursday, May 21st. These meetings offer a fine opportunity to develop contacts in the industry and exchange ideas which may be helpful in the solution of common problems. The secretary of the Association requests that reservations for the event be made as early as possible.

The patents, dies and equipment of the Fidelity Brass Mfg. Company is said to have been sold recently to the Thermalene Corporation of Kankakee, Illinois.

The Alexander Milburn Company, Baltimore, Maryland, recently appointed the Service Tool Company, Columbus, Ohio, as distributors in the Central Ohio district for Milburn oxy-acetylene cutting and welding apparatus.

Secretary Randall of the Cleveland Section of the American Welding Society reports that the April meeting proved unusually interesting and instructive. This was job shop night of the Cleveland Section and the speaker of the evening was W. E. Boom of the Boom Boiler & Welding Company. The evening furnished opportunity for discussion of quite a variety of welding shop problems.

G. P. A. TO MEET IN JULY

It has been decided by the Executive Committee of the Gas Products Association to hold the Annual Summer Meeting at Mackinac Island during the week of July 20th. Members and guests will leave Chicago on July 20th. The program of the Summer Meeting will extend over the 21st, 22nd and 23rd. The place of the convention gives an opportunity for what usually proves to be a delightful boat trip and the Island itself has proven to be a very satisfactory meeting place. Members will be urged to bring their wives along and make this a holiday as well as a business meeting.

Classified Ads

Help Wanted—75c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—$1.00 per line, minimum 4 lines.
Counted 8 words to line. Add 6 words for keyed address

For Sale—Will sell half or whole interest in well established welding shop, full equipped for both electric and oxy-acetyene welding and cutting, good location and low rent. Address F. W. Co., 26 Orange Street, Newark, N. J.

For Sale—Established welding shop and welder's supply station in city of 50,000 population. Owner leaving country. Address P. O. Box 191, Elmira, New York.

Position Wanted—Experienced Combination Welder desires a position as shop foreman or foreman on outside jobs. Has done all sorts of field work, refinery work, shop work and also demonstrating for several large companies. 15 years welding experience. Can furnish best references. Will go anywhere. Address 54, care The Welding Engineer.

For Sale—Service Rights on a limited quantity of W. K. and W. C. Prest-O-Lite Cylinders at attractive prices. Address Remington Arms Co., Inc., Bridgeport, Connecticut.

For Sale—Four cylinders, 180 ft. capacity at 1,800 lbs. pressure, part or all cheap for cash. Address A. B. L., Walworth Mfg. Co., Boston, Mass.

Wanted—Welder thoroughly experienced in job shop acetylene welding, with some knowledge of arc welding. Married man preferred. Permanent job for right man in good Chicago shop. Address 55, care The Welding Engineer.

Wanted—Thoroughly able technical and practical writer of ads, descriptive matter and technical articles upon welding and cutting apparatus, either part or whole time. Address in confidence, giving full particulars to P. O. Box 620, Philadelphia, Pa.

For Sale—Electric and oxy-acetylene welding shop and machine shop, 140x140 foot building with rent income $465 per month. Building occupied by grocery store, hotel, restaurant, apartments and an association. City of 55,000 population. No competition. Price $75,000 including building and business which is nine years old. Address 57, care The Welding Engineer.

Acetylene Welder of 10 years' experience, both railroad and general repairs, desires to make change. Class C member Am. Welding Society. Address A. W. Young, 811 Trimble Ave., Kalamazoo, Mich.

Boiler Maker of 8 years' experience, who is also electric and acetylene welder, desires position either railroad or repair shop. Address Gordon O'Connell, 1628 Lincoln Ave., Kalamazoo, Mich.

For Sale—Welding shop on main thoroughfare of a large California city. Surrounded by small towns and a rich farming country. New 200 amp. welder. Reason for selling have other interests. Address 58, care The Welding Engineer.

Wanted—Two used welding generators. 300 ampere capacity. Address 56, care The Welding Engineer.

Leases on all or any part of five W. C. and thirty-five W. K. Presto-o-Lite Acetylene Tanks. Reasonable.

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2860 Clark Ave., Detroit, Mich.

STATEMENT OF OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of The Welding Engineer, published monthly at Chicago, Illinois, for April 1st, 1925.

State of Illinois, County of Cook, ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared H. S. Card, who having been duly sworn according to law, deposes and says that he is the Business Manager of The Welding Engineer, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act. of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse side of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, G. H. Mackenzie, Chicago, Illinois. Editor, W. W. Brothers, Evanston, Illinois, Managing Editor, H. S. Card, Chicago, Illinois. Business Manager, H. S. Card, Chicago, Illinois.

2. That the owner is: (If the publication is owned by an individual his name and address, or if owned by more than one individual the name and address of each, should be given below; if the publication is owned by a corporation the name of the corporation and the names and addresses of the stockholders owning or holding one per cent or more of the total amount of stock should be given.)

The Welding Engineer Publishing Company, Chicago, Illinois.
G. H. Mackenzie, Chicago, Illinois.
M. J. Hungerford, Chicago, Illinois.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but, also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is ..... (This information is required from daily publications only.)

H. S. Card, Business Manager.

Sworn to and subscribed before me this 31st day of March, 1925.
(Seal.) William Denbach, Notary Public.
(My commission expires April 7, 1925.)

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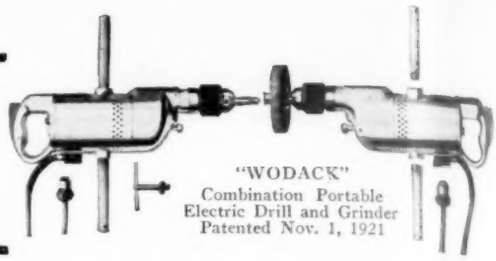

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CURRENT WELDING LITERATURE

WELDED ALUMINUM VESSELS.—Failures in welded aluminum vessels have been traced to impurities in the metal which have led to corrosion. The quality of aluminum intended for use in welded construction is gradually being improved and it is necessary to pay strict attention to this point if the best results are to be secured. There are no serious difficulties in the way of satisfactory welding results but the workers must be well trained and supplied with good equipment.—The Welding Journal, London, Mrach.

ELECTRIC WELDING, by Dr. J. H. Paterson, F. I. C.—Phenomena of the Electric Arc Chemical and Physical Structure of Welding Metal. Electrode Coatings. Mechanical Tests. Practical Welding. Supply of Welding Current.—The Welding Journal, London, March.

OXY-ACETYLENE WELDING IN AUSTRALIA.—The February issue of the Australian Automobile Trade Journal carries a discussion of gas welding and cutting in the automobile industry. Examination papers provided by the Workingmen's College on oxy-acetylene welding and a syllabus of oxy-acetylene and electric arc welding courses are given.

OXY-ACETYLENE TIPS.—A monthly publication of the Linde Air Products Company. The April issue tells how 200 steel towers were reduced to scrap with cutting blow pipes at the world's largest shipyards. How welding eliminate troublesome joints in the construction of steel smoke stacks, gets greater strength and durability and insures longer life. How modern methods cut the cost of production in hand wrought ornamental iron work. How a sand hocker is built by the oxy-acetylene process to keep dry sand on hand as protection against oil fires. How the oxy-acetylene process is used by the electric railways and how some companies handle their jobs.

G. E. WELDING ELECTRODES.—A small 16 page, illustrated booklet just issued by the General Electric Company. This booklet describes the characteristics and applications of the three types of General Electric electrode, designated as Types A, B and C. Brief instructions are given covering the use of each type.

CUTTING AND WELDING EQUIPMENT.—A 52 page, loose leaf catalog issued by the Carbo Oxygen Company, Pittsburgh, Penna. It illustrates and describes a variety of cutting torches, welding torches, special purpose torches, regulators, gauges, hose, hose fittings, goggles, repair kits and repair parts. Operating instructions and pressure tables are given for use in connection with Carbo equipment.

WELDING WITH FLUX COATED ELECTRODES, by C. J. Holslag.—The purpose of the flux is to shield the molten metal, as far as possible, from contact with the air and then to dispose of whatever oxides or nitrides have unavoidably formed. Electrodes may be coated with flux which are chemically active in a favorable way. The use of flux results in a weld of better quality and in some kinds of work is almost indispensable.—Railway Electrical Engineer, March.

HYDROGEN.—The story of hydrogen and methods of producing it. The application of hydrogen in the welding industry for lead burning, cutting and light welding.—Smithograms, March.

NOW—ARC WELDED BUILDINGS.—Book just published by the Westinghouse Electric & Mfg. Company, which describes the construction of a structural steel building by the Burlington Railroad through the use of arc welded joints. Tests are described and illustrated by diagrams by which the approximate strength of welded joints may be estimated. It is stated that in many instances the members used in this building were heavier than necessary, but these were not used, because of their extra weight—they were simply available for use. The photographs reveal a noticeable absence of gusset plates and reinforcing bars, as the tests described indicated that the added reinforcing was unnecessary. Cost data shows a considerable savings over riveted construction. Additional tests of welded joints are illustrated in the booklet.

OXY-ACETYLENE WELDING OF HIGH PRESSURE GAS MAINS.—Particulars and illustrations of some exacting work of this nature which has been successfully carried out in connection with a high pressure gas service in a thickly populated district near London. After the work was finished a final test of 24 hours duration over a total of 20 miles at 100-lb. per square inch showed no leaks whatever.—Industrial Gases, London, March.

DEVELOPMENT OF SPECIAL APPARATUS FOR CUTTING CAST IRON.—A description of some of the successful cuts made on heavy cast iron sections in London. The majority of the work was done with a $\frac{1}{8}$-inch jet at 140 to 150-lb. pressure per square inch. The pressure was raised to 170-lb. when the thickness reached 14 inches. The oxygen consumption is about double that used on cutting similar sections of steel, but even at this figure the process is much cheaper than drilling and bursting with drifts, while the speed of the work is such that as much can be done in one day as would take a week with a drill.—Industrial Gases, London, March.

SOME DIFFICULTIES IN CONNECTION WITH AUTOGENOUS WELDING OF MILD STEEL.—Many failures in the application of autogenous welding to steel structural work which have not heretofore been explained are now attributed to the presence of impurities in the base metal. In some of the manufacturing processes the steel which is perfectly good on the outside contains objectional impurities localized at the center, and the result of welding two pieces of such metal is generally unsatisfactory. The author's conclusion seems to indicate that open hearth steel is more satisfactory for welding purposes than Bessemer steel, but even then it is necessary to verify the quality of the base metal.—Industrial Gases, London, March.

J'INSTALLE LA SOUDURE AUTOGENE, by R. Granjon, P. Rosemberg, A. DesGranges.—A volume of 80 pages with numerous illustrations. This little book gives a fund of very valuable information about the different types of oxy-acetylene apparatus available in France together with instructions for installation and operation of welding outfits. It treats all of the processes known and used in France and finishes with the regulations which are current there for the installation of oxy-acetylene welding and cutting apparatus. Published by Publications de l'office Central de la Soudure Autogene, 104, Bd. de Clichy, Paris (18). Price 3 Francs.

J'APPRENDS LA SOUDURE AUTOGENE, by R. Granjon, P. Rosemberg, A. Desgranges.—A volume of 144 pages with 175 illustrations. The use of this book follows logically the one mentioned above, for it concerns itself with the matter of learning how to use the apparatus after it has been installed. It contains a great deal of real indispensable information for both the apprentice welder and the experienced workman. After mentioning briefly the subject of the installation, the selection of material and putting the apparatus into operation, the authors give detailed instructions on the examination of a weld, the good qualities and usual defects found in welds. Then they take the reader through a series of five discussions of practical application. The best methods of making welds in steel, cast iron, aluminum, copper, brass and bronze are given at the end of the volume. Published by Publications de l'Office Central de la Soudure Autogene, 104 Bd. de Clichy, Paris (18). Price 4 Francs.

HEAT EXCHANGERS USED IN CONNECTION WITH GASOLINE EXTRACTION PLANTS.—The heat exchanger consists of a series of pipe one within the other, assembled in a very ingenious way, and are vital to the successful operation and economy of absorption plants. This is an excellent example of apparatus constructed by welding which it would be almost impossible to construct in any other way.—Acetylene Journal, May.

AUTOGENOUS WELDING AND CUTTING AS PRACTICED ON THE A. T. & S. F. RAILROAD, by E. E. Chapman and H. H. Service.—Early experiments with oxy-acetylene welding. Tests on rails to determine what welding should be done. Tire welding and cutting. Locomotive frame welding. Welding crossing rails. Cutting tests. Welding side frames and couplers.—Acetylene Journal, May.

A. W. S. TECHNICAL SESSION.—A collection of papers on the subject of welding procedure, inspection and tests presented at the Technical Session of the Annual Meeting of the American Welding Society, April 24th. Special emphasis is laid on rail joint welding and on methods of testing finished welds.—Journal of the A. W. S., April.

SIX LECTURES OF AUTOGENOUS WELDING—143-page book containing a very useful collection of lectures on the following welding subjects: history of welding; actual state of the art; metals and industrial alloys considered from the point of view of welding; practical lessons on expansion and contraction in welding; examples on steel, cast iron and aluminum; welding flame; defects of welds; different methods of executing welds; welding copper, brass, bronze, aluminum and lead; acetylene generators, torches, regulators, filler rods; cutting torches and their use; technique in practice of cutting. Published by Publications de l'Office Central de la Soudure Autogene, 104, Bd. de Clichy, Paris (18). Price 4 Francs.

AUTOGENOUS WELDING ON REINFORCED CONCRETE CONSTRUCTION.—A brief discussion of the use of welding in making such joints as are necessary in reinforcing members and containers used in concrete work. La Soldadura Autogena Y sus Aplicaciones, February.

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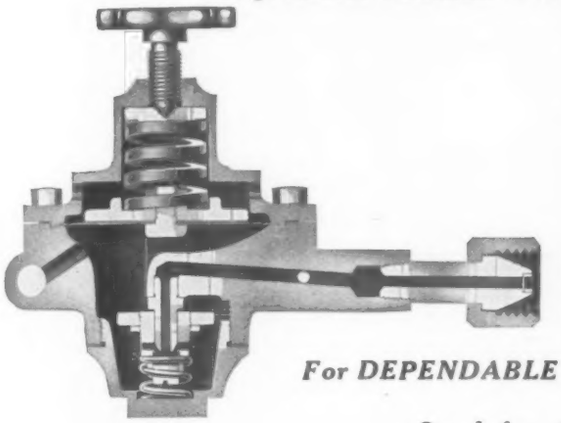

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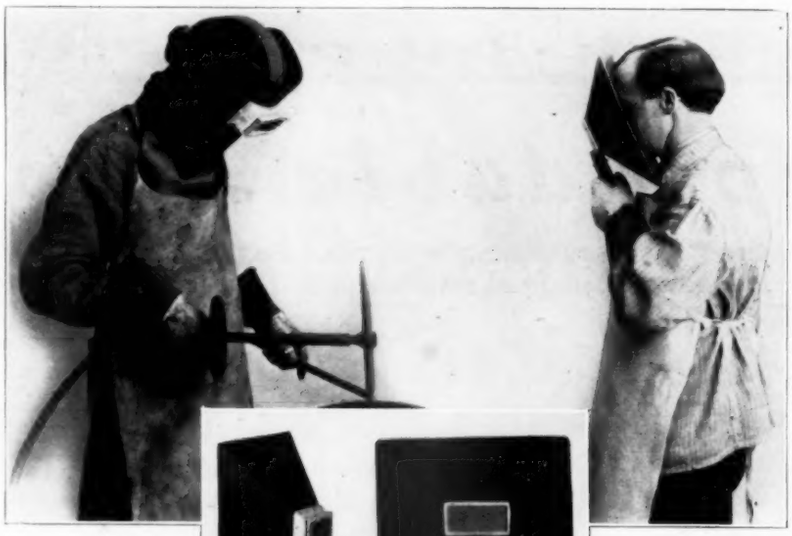

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All "Raco" Welding Wires are guaranteed to meet the American Welding Society specifications in every particular, and in addition are subject to rejection from any cause whatsoever.
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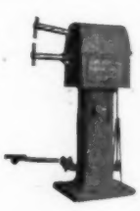

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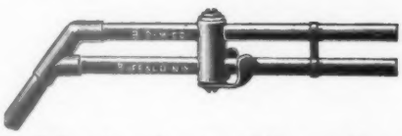

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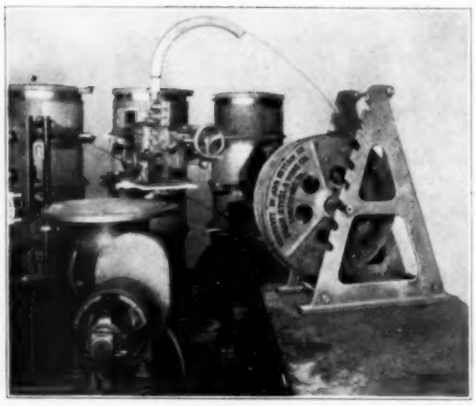

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PAGE - ARMCO

Gas Welding Wire and Electrodes

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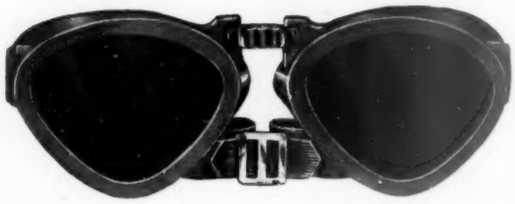

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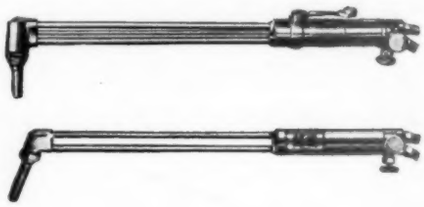

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Superior Oxy-Acetylene Machine Company

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Welding and Cutting Torches that will not flash-back.
Carbon Burning and Lead Burning Outfits.
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50-lb.	250 cu. ft.	$235.00
100-lb.	500 cu. ft.	340.00
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These Generators are Automatic, equipped with the CELEBRATED SUPERIOR FEED, with either WEIGHT DRIVEN—or SPRING DRIVEN MOTOR.

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CAST IRON RODS: All sizes, cast round or square, high in silicon, give a nice soft weld.

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WESTINGHOUSE ELECTRIC

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CROSS-SECTION
NO EXPOSED METAL
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REMOVABLE
2-POINT SUSPENSION at REAR ONLY KEEPS HEAT FROM SPRING
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THIS BRAZED-IN COPPER LINK TRANSMITS CURRENT BUT NOT HEAT-NOTE SEPARATION OF CASTINGS
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QUICK-ACTING ALLIGATOR JAWS MEAN RAPID & EASY DISPOSAL OF USED ELECTRODE TIP

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"CAMPBELL — TYPE" WELDING HANDLE

We bought the patent rights to this handle in 1918 from John J. Campbell of the Brooklyn Navy Yard and have developed it continuously for seven years.

THE HANDLE WILL NOT GET HOT AT THE HOLDING END.
THE SPRING WILL NOT LOSE ITS TEMPER OR BREAK.
THE JAWS WILL NOT BURN AWAY BY ARC USE.
PLEASE NOTE APPROVAL ORDER AT BOTTOM OF THIS PAGE.

Experience produces the best results, and we have relied upon experience to produce what we think is the most carefully developed welding handle on the market today. This development was not based on untried theory, but, instead each improvement came into being to meet requirements of hard and continued use.

Look at the pictures above. It tells you everything at a glance. See how the strongly tempered spring is placed so that it holds the heavy jaws tight with greatest lever action. Yet, a squeeze of the hand, and the jaw opens wide to drop the used electrode end. Insertion of a fresh electrode is just as rapid.

Did you notice that the jaws of the handle are entirely separate from the terminal connections, and in fact, from all that part of the handle covered by the hand. This is one of the most radical improvements ever devised in a welding handle, because it means that the heat positively cannot mount up. Moreover the casting is so ribbed that every part of the handle is ventilated, which means that its use may be continuous and convenient.

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Send me on approval one Campbell welding handle with (without) leads. It is understood that I am to have the privilege of return within five days, but if I decide to use the handle I will pay $10.00 if ordered with leads and $7.50 if ordered without leads.

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